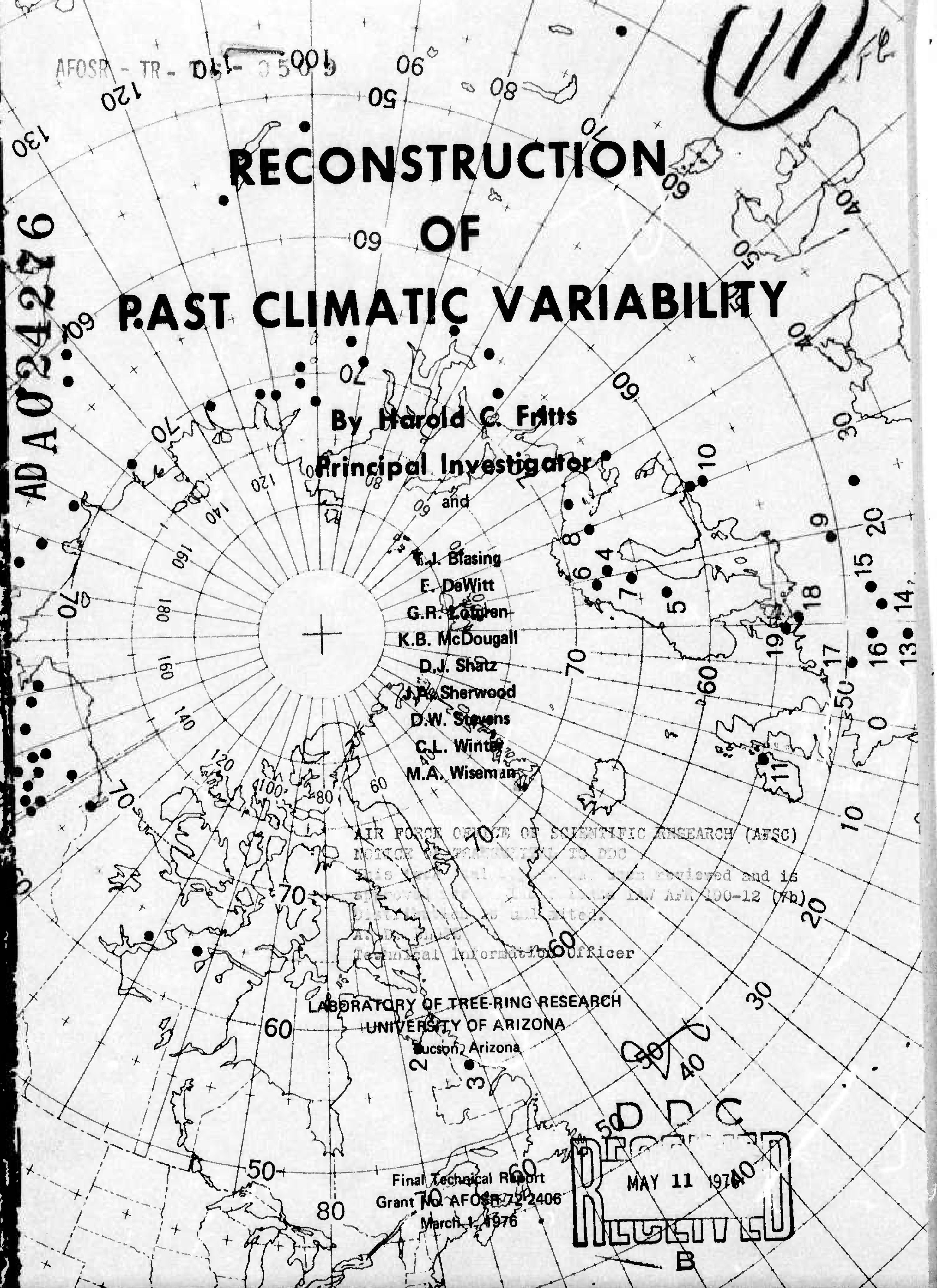

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RECONSTRUCTION OF PAST CLIMATIC VARIABILITY

By Harold C. Fritts
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and

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UNIVERSITY OF ARIZONA
Tucson, Arizona

Final Technical Report
Grant No. AFOSR-72-2406
March 1, 1976

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Sponsored by Advanced Research Projects Agency

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Tree rings; climate; climatic variations; statistics; North America; Europe; paleoclimate.

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Results are reported from the first ~~three~~ 3 years of a ~~five~~ 5-year project to reconstruct past climatic fluctuations in the Northern Hemisphere from variations in the growth rings of trees. (1) The most significant result~~, is the~~ growing international collaboration stimulated by this research effort; ~~The second is~~ (2) the development of 127 high-quality tree-ring chronologies from North America and Europe; (3) Other developments include the establishment of the International Tree-Ring Data Bank; (4) evaluation of multivariate techniques for calibration and

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and (5)
analysis; the selection of a revised data set for reconstructing North American climate, and several other technical achievements. These results now will be used to improve reconstructions of past climate and to expand them to eastern North America and Europe.

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A. The Problem

In order to extend our knowledge of climatic variations back through time, especially for sparsely settled areas of the globe, it is necessary to use a variety of proxy records or surrogates of past climate. The rings of trees are an especially valuable record of yearly variations in past climate because they can be dated to the exact year in which they were formed, and, therefore, temporally precise estimates of climate can be derived from their measurements. In fact, considerable research at present supports the contention that reconstructions of spatial anomaly patterns of surface pressure (atmospheric circulation patterns) for the North American and North Pacific sectors, including portions of the Pacific Ocean, can be estimated from spatial variations in tree growth, represented by well-replicated tree-ring chronologies, for sites throughout western North America.

The purpose of this research is to extend the methods and data used in analyzing western North American trees to hemispherewide climatic analysis. The report summarizes the important technical results from three years of ARPA-supported work including the collection of basic materials, the processing and development of proxy information from the collections, and the application of the information to analyses of climatic variations. More importantly, it describes the indirect, but significant, effect the ARPA work has had on dendroclimatology, a scientific subdiscipline crucial to the problem of estimating past climatic variation. To provide a background for evaluating the significance of this project, the latter, more indirect international contributions are summarized first.

B. The International Growth of Dendroclimatology

Dendroclimatology (the use of dated tree rings to study climate) is a part of the better-known discipline of dendrochronology (tree-ring dating). Dendroclimatology has become an increasingly important field of investigation during the last decade, especially during the last several years. The acceleration in its growth is a function of more worldwide direct contacts, increasing working relationships among scientists in different laboratories, and the keen interest of workers which has been generated in large part by activities at the Laboratory of Tree-Ring Research. The ARPA-supported activities and the travels undertaken by the Principal Investigator have been especially instrumental in the development of an international collaborative working group. The group has grown from a handful of people to include more than 75 leading scientists from 18 countries throughout the world.

In addition, the following achievements have resulted from the ARPA work:

1) A highly successful two-week International Workshop of Dendroclimatology was held in Tucson April 15-26, 1974;
2) An International Tree-Ring Data Bank was formed and implemented;
3) Direct relationships among American and Soviet scientists were established through two visits of H. C. Fritts to the U.S.S.R. and through a bilateral collaboration agreement between the United States and the U.S.S.R.;
4) A total of 23 basic tree-ring chronologies have been contributed from Europe and are being placed in the Data Bank;
5) A number of international scientists have already collected and are working on materials which they plan to use with our help to study past climate.

C. Basic Principles Underlying the Research

Dendroclimatic research, as described in this report, is based upon the simple principle that trees growing on stress sites lay down wide or narrow rings depending upon the conditions of weather and climate that affect plant processes. Thus, the tree-ring records contain, among other things, information on variations in past climate. In order to enhance the climatic information and minimize the nonclimatic variations, great care is taken to collect from only those trees most limited by climate and to sample a variety of habitats so that much of the nonclimatic variability is averaged out while the similarities representing macroclimatic information are enhanced. Also, because there is a finite, but small, likelihood that a ring may be missing or mistakenly identified on a particular sample, a tedious and time-consuming procedure must be employed to crossdate all ring records before they are measured, processed, and analyzed. The dating procedure alone consumes one-third of the total collecting-processing effort.

D. Tree-Ring Collections

A total of 104 separate high-quality chronologies from the contiguous United States and nearby areas of Mexico have been collected and processed under the auspices of the ARPA project. These are part of a larger collection of 218 North American chronologies and materials. For the sake of brevity, only the highest-quality sets are reported. If the chronologies from the North American Arctic and Europe are added to the selected list, a total of 127 new chronologies can be reported. ARPA collection efforts outside the United States involved scientists from the countries concerned or were obtained with the full knowledge and consent of the respective governments. All research with these materials has been conducted in the United States.

The collection and processing of a single site to develop a year-to-year ring-width chronology of variations in climate has been estimated to cost $1,500. If one estimates the dollar value of the 104 chronologies from the contiguous United States alone, it amounts to $156,000 or approximately 61% of the entire ARPA support. This unusually high return occurred because the ARPA support served as seed money to initiate projects which were then continued on other grants. Actually, more than 104 high-quality chronologies resulted from the total effort but only those directly involving ARPA funds are tabulated.

E. Computer Program Development

New computer equipment and related software development are reported which facilitate our work and are especially important to the research underway at the moment. Included are programs to assist batch processing, new text-editing capabilities, and interactive programs developed for a Texas Instruments Model 725 terminal provided for the project. A number of tests of particular climatic hypotheses which are mentioned in the report were possible because of the computer software and hardware which were developed.

F. Results

Since tree-ring data around the world vary markedly in their quality and density over space, two methods of calibration were studied to test their use in areas where only one or two chronologies characterize regional climate. One method involved multiple regression using tree-ring values coinciding with, or lagging behind, the occurrence of climate as predictors. The other method employed canonical analysis, using several chronologies to estimate records of climate.

The results of the first method are significant and were verified on independent data for six out of ten cases in which the calibration regression coefficients were significant. All tests of the second method are not completed, so details are not reported. The first method appears to be most effective in areas where tree-ring data are sparse, but the method is less powerful than the second if large errors occur in either the tree-ring or climatic calibration data set. We anticipate that the second method, using canonical variates, will help to separate the small-scale noise from the large-scale information on climate, but more tree-ring data are required to accomplish the analysis.

Other results are reported in the text or described in the 16 manuscripts or publications listed in the last section. The Appendix is a paper describing our methods of selection and characterization of tree-ring data sets for use in climatic analyses.

The project was a part of a larger effort involving the University of Wisconsin (Grant AFOSR 72-2407). In the last two years of this proposed five-year project, we had planned to apply our capabilities at the two universities to the larger problem of continentwide climatic reconstruction and analysis. Since the work has been terminated prematurely, we cannot provide conclusive results at this time regarding such regional analyses.

However, our particular ARPA project at the University of Arizona has been coordinated with another research effort (NSF Grant GA-26581) which was to use existing tree-ring records to reconstruct past climate. This work is continuing with a new grant (NSF Grant ATM75-22378) and has been expanded to utilize some of the technological developments resulting from the ARPA study. Already we are applying the newly revised tree-ring grid of 89 sites

reported in the Appendix to make improvements in our calibrations and to extend reconstructions of climate further back in time.

A new NSF project (NSF Grant ATM75-17034) has also been funded to develop applications and to carry forward the expansion of our techniques to hemispherewide analysis.

The last manuscript cited in Section XII, *Tree Rings and Climate* by H. C. Fritts, has been in preparation for about six years. While ARPA funds have not been solicited directly for the book, a large number of examples, references, and results from the ARPA effort are included in the volume along with other studies and facts relevant to the general topic. In addition, ARPA-supported personnel have at times been involved in preparation of this as well as other cited manuscripts.

G. Conclusions

The most basic objective of this study has been achieved--the development of a new and more extensive tree-ring data base. Also, much progress is reported on hemispherewide efforts of climatic reconstruction which is best measured by the growth of the discipline, increased international collaboration, and by the ARPA technological developments. The work has contributed to all sections of the Laboratory of Tree-Ring Research and has helped to build both a technological base and well-trained staff which can continue to provide world leadership in the field of dendroclimatic analysis.

The full impact of the effort is not yet fully visible. Its significance should become more and more evident in the years to come as the actual reconstructions of past climatic variations are compiled into a meaningful picture

beginning in North America, expanding to Europe and thence to other areas of the Northern Hemisphere, and ultimately to all continents and oceans adjacent to semiarid, temperate, or cold-region forests.

II. INTRODUCTION

There is a growing awareness that climate could be changing, that the world's food and energy supplies could be increasingly affected by climatic variations, and that more effort needs to be directed to the task of anticipating future conditions of climate. It is also becoming apparent that climatic changes occur on all time scales, and that our knowledge of the spatial and temporal character of climatic variations becomes less accurate as we work back in time from the present.

One can be optimistic about the possibility of statistical forecasting of weather and climatic variations for a few days, weeks, or even months in the future because relatively good physical models already exist for such, and there is a sufficient number of observations to develop the necessary statistics. However, there is insufficient knowledge of and a lack of studies on climatic variations for time scales of 1 to 100 years. Therefore, it is still difficult to anticipate long-range changes in climate. This lack is in part imposed by unavailability of data. For example, there are only 25 to 30 years of upper air data and only 70 years of surface observations from a moderately dense network available for analysis of yearly climatic variations; and a relatively small number of weather stations have long enough records to provide even 10 independent observations of decades (100 years), which is a number generally considered too small to derive meaningful statistics. In order to obtain more information on the nature of past climatic variability on time scales of years to millenia, it is necessary to go beyond existing weather records to proxy data, i.e., environmentally sensitive chronologies that have recorded past variations in climate for a particular region or site.

This report covers three years of research of a five-year project to extend our knowledge of year-to-year variations in climate back in time by

use of well-dated proxy series of climate such as tree rings. Such climatic reconstruction is possible because ring-width growth on stress sites is limited in years of minimal moisture, anomalous temperatures, and other climatic factors. Therefore, biological records of climate can be obtained from replicate sampling of rings from trees on a variety of sites over a wide geographic area. Spatial variations in tree growth for each year can be calibrated with recorded climate, and the calibration equation is applied to growth in past years to estimate the associated variations in past climate. Work prior to the funding of this project has focused mainly on arid site trees from western North America and on pressure over North America and the North Pacific Ocean. The first objective of this study was to expand the tree-ring data base. This widened data base is to be applied to an expanded set of climatic data to include the North Atlantic, Europe, and Asia.

The first two technical sections of this report (Sections III and IV) describe the progress in the collection of tree-ring chronologies and an estimate of their present dollar value. Section V deals with recent international developments related to dendroclimatology including a discussion of the International Tree-Ring Data Bank and a report on most recent travels.

Section VI and the attached Appendix describe the selection of an improved tree-ring grid for climatic reconstructions and evaluation of the statistical characteristics of the grid. Sections VII and VIII describe the current status of a test of calibration procedures and some attempts at several new applications. New computer programs developed for the general research effort are described in Section IX.

Section X is a general summary of the significance of the entire ARPA effort, while the last two sections include lists of personnel supported by the grant and publications resulting from or related to the effort.

III. COLLECTIONS

A. North American Temperate Sites

The collections originally itemized in earlier reports as Tasks 1, 2, and 4, represent a major portion of the first three-year ARPA effort and include work which has now been taken over by other grants. Collections have been obtained from 36 distinct localities of the United States and Canada. Localities 1 through 35 (Fig. 1) include 55 tree-ring chronologies which were in turn selected from 118 collected samples (see Table I).

Locality 36 includes 30 well-defined sites with a total of 49 chronologies as shown in Figure 2 and itemized in Table II. Thus, out of a total of 184 tree-ring collections, we now report a total of 104 new chronologies of sufficient length and quality to be used for climatic reconstruction work.

B. North American Arctic Sites

Figure 3 is a map of the available chronologies of the Northern Hemisphere for sites outside the contiguous United States, western Canada, and Mexico. Twenty-one sites shown in Alaska and the Yukon and Northwest Territories as mapped by Blasing and Fritts (Section III, No. 3) had been collected and processed prior to the ARPA project. However, one very excellent chronology, Herring-Alpine, from an island in Prince William Sound, was dated and processed as part of the ARPA-supported effort. The collections in Labrador and Fort Chimo are presently being processed. The most northern of these, Fort Chimo, will be a large and excellent chronology extending back to 1641. Data concerning these chronologies are shown in Table III. Although the Labrador collections are too short to be included in a climate reconstruction set, they are shown, too, as they represent the only known data for that area of the eastern North America coast.

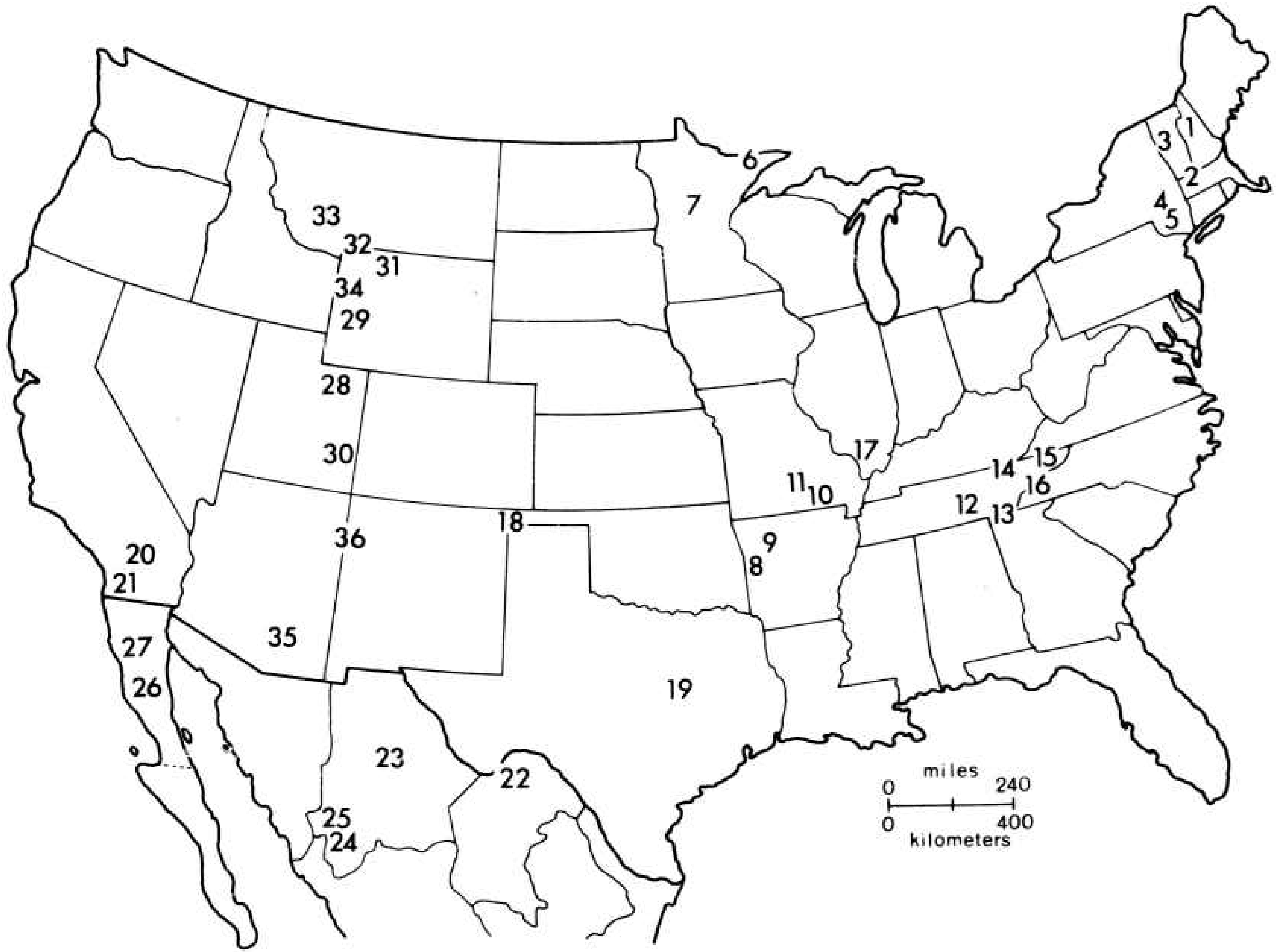

Figure 1. Site localities in the contiguous United States and Mexico yielding one or more high-quality tree-ring chronologies usable for dendroclimatic analysis. (See Table I.)

TABLE I

Collections from North American Temperate Sites

(See Figure 1)

Map Reference	ID Number	Site Name	Species[1]	Time Span	Completed	Cores	Trees	Collectors[2]
1	297899	Nancy Brook, NH	PCRU	1561-1972	Yes	26	13	HCF, TGS
2	293899	Livingston, MA	PCRU	1697-1972	Yes	20	10	HCF, TGS
3	559890	Camel's Hump, VT (A, B, and C merged)	PCRU	1635-1972	Yes	50	25	TGS
4	378930	Mohonk Lake, NY	TSCA	1636-1973	Yes	30	15	EC
4	420809	Mohonk Lake, NY	PIRI	1622-1973	Yes	32	16	EC
4	368900	Mohonk Lake, NY	PIST	1626-1973	Yes	32	16	EC
4	367859	Mohonk Lake, NY	QUPR	1690-1973	Yes	46	23	EC
5	391899	Giant Ledge, NY	PCRU	1679-1972	Yes	20	10	TGS
6	577929	Seagull Lake, MN (merged)	PIRE	1625-1971	Yes	26	13	HCF, MLH, AS, LC
6	553927	Saganaga Lake, MN (merged)	PIRE	1620-1972	Yes	34	14	HCF, MLH, AS, LC
7	430928	Itasca State Pk., MN (merged)	PIRE	1672-1971	Yes	36	18	HCF
8	390849	Montgomery Co., AR (to merge with Big Brushy Mtn., AR)	PIEC	1666-1939	Yes	39	39	REB, FH

[1] See Key to Species, page 17.
[2] See Key to Collectors, page 18.

Table I, cont.

Map Reference	ID Number	Site Name	Species	Time Span	Completed	Cores	Trees	Collectors
8	388849	Big Brushy Mtn., AR	PIEC	1760-1972	Yes	41	20	MAW, CWS, JBH
8	311___	Polk County, AR (to merge with Brush Heap Mtn., AR)	QUAL	1676-1940	No			REB, FH
8	354819	Brush Heap Mtn., AR	QUAL	1720-1972	Yes	25	14	MAW, CWS, JBH
9	383819	Pope County, AR (to merge with Russellville, AR)	QUAL	1642-1939	Yes	30	15	REB, FH
9	384819	Russellville/A, AR	QUAL	1713-1972	Yes	25	12	MAW, CWS, JBH, EE
10	385819	Carter County, MO (to merge with Mark Twain and Winona, MO)	QUAL	1642-1936	Yes	54	42	REB, FH
10	387819	Mark Twain Nat. For., MO	QUAL	1783-1972	Yes	34	17	MAW, CWS, JBH, EE
10	160000	Winona, MO	QUAL	1780-1966	Yes	20	10	EE
11	389819	Shannon County, MO (to merge with Soc. Am. Foresters Plot, MO)	QUAL	1588-1936	Yes	36	36	REB, FH
11	386819	Soc. Am. Foresters Plot, MO	QUAL	1725-1972	Yes	24	12	MAW, CWS, JBH, NR
12	412819	Warren County, TN (to merge with Falls Creek Falls, TN)	QUAL	1669-1941	Yes	37	26	REB, FH

Table I, cont.

Map Reference	ID Number	Site Name	Species	Time Span	Completed	Cores	Trees	Collectors
12	431819	Falls Creek Falls, TN	QUAL	1767-1972	Yes	23	12	MAW, CWS, JBH
12	436989	Falls Creek Falls, TN	QUST	1678-1972	Yes	9	4	MAW, CWS, JBH
13	395848	Savage Gulf High and Low, TN (merged)	PIEC	1646-1972	Yes	48	24	MAW, CWS, JBH
14	432819	Steiner's Woods, TN	QUAL	1625-1972	Yes	14	7	CWS, RB, DB
15	438___	Norris Watershed Boundary, TN	PIEC		No			CWS, RB, DB
16	______	Newfound Gap, NC	PCRU	1685-1972	No			MAW, JBH
17	396818	Ferne Clyffe, IL (merged)	QUAL	1685-1972	Yes	34	17	EE, MAW CWS, JBH
18	406640	Kenton, OK	PIPO	1640-1974	Yes	12	6	TPH, EC
19	731___	Oak Park, TX	QUST	16__-1974	No			TPH, EC
20	323599	San Gorgonio, CA	PIFL	42 B. C.-1970	Yes	31	30	RT, TPH
21	247529	Santa Ana Mtns., CA	PSMA	1611-1972	Yes	30	15	AVD
22	271540	Sierra del Carmen/Madera Canyon A, Coahuila, Mexico	PSME	1675-1971	Yes	16	8	MAS, CWS
23	269547	Sierra del Nido B1, Chihuahua, Mexico	PSME	1569-1971	Yes	12	6	TPH, THN, AVD
23	269597	Sierra del Nido B2, Chihuahua, Mexico	PISF	1634-1971	Yes	6	3	TPH, THN, AVD

Table I, cont.

Map Reference	ID Number	Site Name	Species	Time Span	Completed	Cores	Trees	Collectors
24	265541	Sierra Madre/Creel Airport, Chihuahua, Mexico	PSME	1643-1972	Yes	12	6	THN
25	352549	Sierra Madre/Rio Verde, Chihuahua, Mexico	PSME	1634-1973	Yes	16	8	THN
26	337579	San Pedro Martir Low, Baja, Mexico	PIJE	1440-1972	Yes	38	21	MAS, TPH, SBC
26	339579	Vallecito, Baja, Mexico	PIJE	1564-1971	Yes	32	17	MAS, TPH, SBC
26	338___	Tasajera, Baja, Mexico	PIJE	1559-1972	No			MAS, TPH, SBC
26	341659	Tasajera, Baja, Mexico	ABCO	1664-1972	Yes	26	15	MAS, TPH, SBC
27	349___	Baja/N/Topo, Mexico	PIJE	1616-1972	No			MAS, TPH, SBC
27	335469	Baja/N/Pond, Mexico	PIQU	1659-1960	No			MAS, TPH, SBC
28	277550	Uinta Mtns. A, UT	PCEN	1433-1971	Yes	20	10	CWS, JBH, GJ
28	279540	Uinta Mtns. C, UT	PSME	1635-1971	Yes	18	9	CWS, JBH, GJ
28	280620	Uinta Mtns. D, UT	PIED	1423-1971	Yes	8	4	CWS, JBH, GJ
28	281550	Uinta Mtns. North, UT	PCEN	1605-1971	Yes	18	9	CWS, JBH, GJ
29	102590	Windriver Mtns. A, WY	PIFL	1678-1971	Yes	14	7	CWS, JBH, GJ
29	101540	Windriver Mtns. B, WY	PSME	1562-1971	Yes	24	12	CWS, JBH, GJ
29	282540	Windriver Mtns. C, WY	PSME	1504-1972	Yes	22	11	CWS, JBH, GJ

Table I, cont.

Map Reference	ID Number	Site Name	Species	Time Span	Completed	Cores	Trees	Collectors
29	283590	Windriver Mtns. D, WY	PIFL	1492-1972	Yes	20	10	CWS, JBH, GJ
30	285620	La Sal Mtns., UT	PIED	1489-1972	Yes	18	9	CWS, JBH, GJ
31	315549	Dead Indian Hill, WY	PSME	1580-1971	Yes	17	8	CWF, DGD
32	052549	Gardiner A, MT	PSME	1185-1971	Yes	26	13	CWF, DGD
32	052590	Gardiner B, MT	PIFL	1410-1971	Yes	14	7	CWF, DGD
33	317540	Spanish Creek, MT	PSME	1623-1972	Yes	20	10	CWF, DGD, DBH
34	316590	Gros Ventre, WY	PIFL	1462-1971	Yes	18	9	CWF, LL
34	318599	Uhl Hill, WY	PIFL	1400-1971	Yes	22	11	CWF
34	552590	Gros Ventre and Uhl Hill, WY (merged)	PIFL	1400-1971	Yes	24	12	CWF, LL
35	321549	Rincon Peak, AZ	PSME	1621-1972	Yes	18	9	JY, TPH, SBC

Key to Species for Tables I, II, III, and V

Abbreviation	Common Name	Scientific Name
ABAL	European fir	*Abies alba*
ABCO	white fir	*Abies concolor*
JUOS	Utah juniper	*Juniperus osteosperma*
LADE	European larch	*Larix decidua*
LALA	tamarack	*Larix laricina*
PCAB	Norway spruce	*Picea abies*
PCEN	Engelmann spruce	*Picea engelmanni*
PCGL	white spruce	*Picea glauca*
PCMA	black spruce	*Picea mariana*
PCRU	red spruce	*Picea rubens*
PICE	stone pine	*Pinus cembra*
PIEC	shortleaf pine	*Pinus echinata*
PIED	Colorado pinyon	*Pinus edulis*
PIFL	limber pine	*Pinus flexilis*
PIHA	Aleppo pine	*Pinus halepensis*
PIJE	jeffrey pine	*Pinus jeffreyi*
PIPO	ponderosa pine	*Pinus ponderosa*
PIQU	Parry pinyon	*Pinus quadrifolia*
PIRE	red pine	*Pinus resinosa*
PIRI	pitch pine	*Pinus rigida*
PISF	western white pine	*Pinus strobiformis*
PIST	white pine	*Pinus strobus*
PISY	Scotch pine	*Pinus sylvestris*
PSMA	big cone spruce	*Pseudotsuga macrocarpa*
PSME	Douglas-fir	*Pseudotsuga menziesii*
QUAL	white oak	*Quercus alba*
QUPR	chestnut oak	*Quercus prinus*
QUSP	European oak, species unknown	*Quercus* spp.
QUST	post oak	*Quercus stellata*
TSCA	hemlock	*Tsuga canadensis*
TSHE	western hemlock	*Tsuga heterophylla*

Key to Collectors for Tables I, II, and III

Abbreviation	Collectors
AM	André V. Munaut, Laboratoire de Palynologie et Phytosociologie, Louvain-la-Neuve, Belgium
AS	Albert M. Swain, University of Wisconsin, Madison
AVD	Arthur V. Douglas, Laboratory of Tree-Ring Research, University of Arizona, Tucson (TRL)
BAK	Boris A. Kolchin, Institute of Archaeology, Moscow, U.S.S.R.
BB	Bernd Becker, Universität Hohenheim, Stuttgart, Federal Republic of Germany
BJ	Bengt Jonsson, Royal College of Forestry, Stockholm, Sweden
BTB	Barney T. Burns III, TRL
CWF	C. Wesley Ferguson, TRL
CWS	Charles W. Stockton, TRL
DB	Douglas Bean, T.V.A., Knoxville, Tennessee
DBH	D. B. Houston, Yellowstone Nat. Park, Wyoming
DE	Dieter Eckstein, Universität Hamburg, Federal Republic of Germany
DGD	Donald G. Despain, Yellowstone Nat. Park, Wyoming
DOB	Dennie O. Bowden, TRL
EC	Edward Cook, Lamont-Doherty Geol. Obs., Palisades, New York
EE	Eugene and Retta Estes, Rend Lake College, Ina Illinois
EH	Ernst Hollstein, Rheinisches Landesmuseum, Trier, Federal Republic of Germany
FH	Florence Hawley Ellis, Formerly Univ. of Chicago Tree-Ring Lab., presently Univ. of New Mexico, Albuquerque
FS	Francoise Serre, Laboratoire de Botanique Historique et Palynologie, Faculté des Sciences et Techniques de St. Jérome, Marseilles, France
GJ	Gordon Jacoby, formerly Lake Powell Project, Flagstaff, Arizona, presently Lamont-Doherty Geol. Obs., Palisades, New York
GS	Gustaf Sirén, Royal College of Forestry, Stockholm, Sweden
HCF	Harold C. Fritts, TRL
HEW	Herb E. Wright, Univ. of Minnesota, Minneapolis
JBH	James B. Harsha, formerly TRL
JP	Jonathan Pilcher, Queen's Univ., Belfast, Northern Ireland
JSD	Jeffrey S. Dean, TRL
JT	Jaan Terasmae, Brock Univ., St. Catharines, Ontario, Canada
JY	John Yu, TRL
KB	Klaus Brehme, formerly Universität Hamburg, Federal Republic of Germany
LC	Lawrence Conrad, Dept. of Anthropology, Univ. of Wisconsin, Madison
LL	Lloyd Loope, Grand Teton Nat. Park, Wyoming
MAS	Marvin A. Stokes, TRL
MAW	Martha Ames Wiseman, TRL
MB	Michael G. L. Baillie, Queen's Univ., Belfast, Northern Ireland
MLH	Miron L. Heinselman, North Central For. Expt. Sta., St. Paul, Minnesota
NR	Nelson Rogers, Sinkin Expt. Forest, Salem, Missouri
RB	Roger Betson, T.V.A., Knoxville, Tennessee
REB	Robert E. Bell, formerly Univ. of Chicago Tree-Ring Lab., retired from Univ. of Oklahoma, Norman
RLW	Richard L. Warren, TRL
RT	Robert Tosh, Mentone, California
SBC	Scott B. Clemans, TRL
TGS	Thomas G. Siccama, Yale School of Forestry and Environmental Studies, New Haven, Connecticut
THN	Thomas H. Naylor, TRL
TJS	Thomas J. Sheehy, Chugach Nat. Forest, Anchorage, Alaska
TPH	Thomas P. Harlan, TRL
VCL	Valmore C. LaMarche, Jr., TRL
WJR	William J. Robinson, TRL
WW	Wallace Woolfenden, TRL
ZB	Zdzisław Bednarz, Akademia Rolnicza Wydzial Leśny, Kraków, Poland

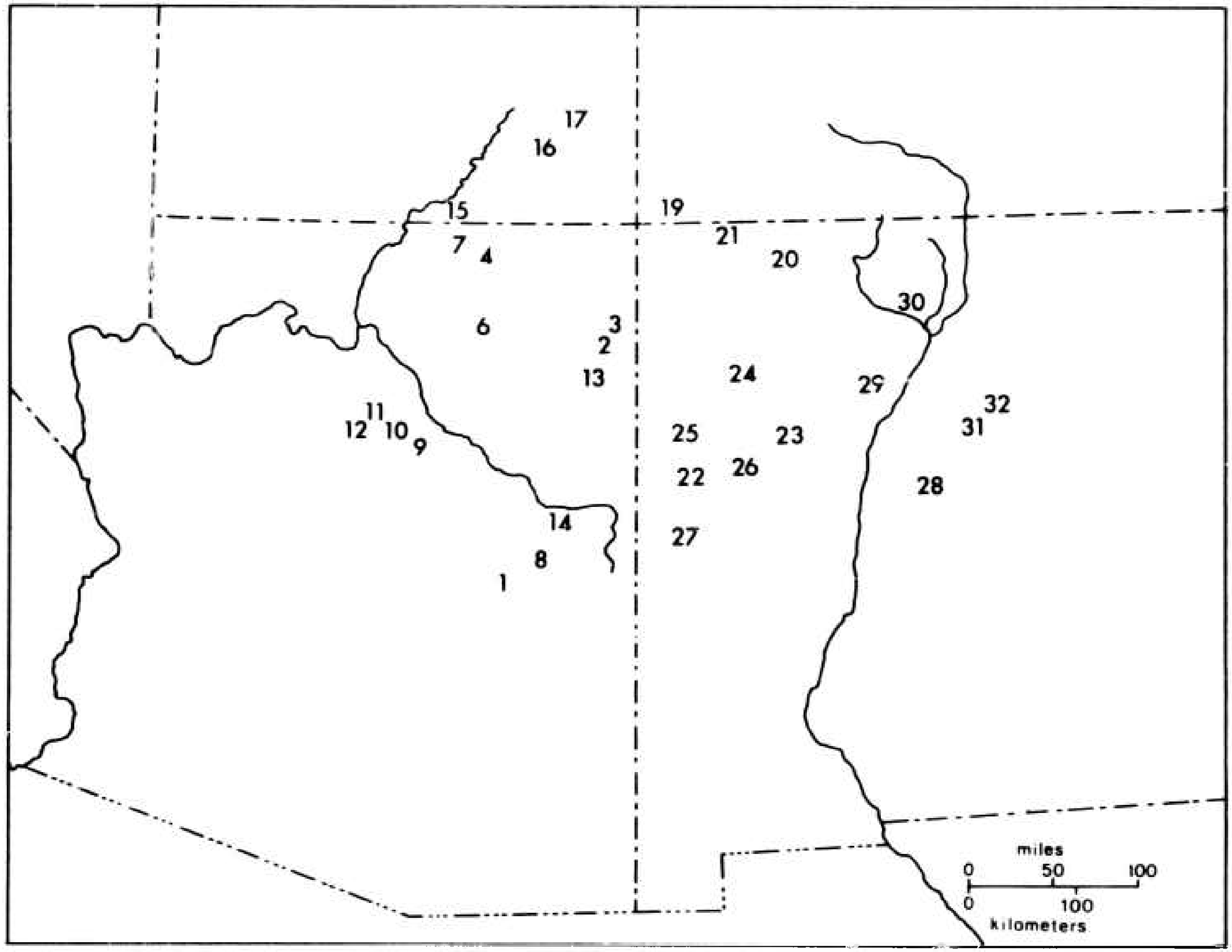

Figure 2. Detail map of the 30 sites in locality 36 (Fig. 1) in southwestern United States which yielded one or more high-quality tree-ring chronologies which are usable for dendro-climatic analysis. (See Table II.)

TABLE II

Collections from Southwest Plateau Area

(See Figure 2)

Map Reference	ID Number	Site Name	Species[1]	Time Span	Completed	Cores	Trees	Collectors[2]
36-1	022000	Grasshopper, AZ	PIPO	1642-1971	Yes	28	14	JSD, RLW
36-1	042000	Salt River Draw, AZ	PIPO	1677-1971	Yes	20	10	JSD, RLW
36-1	033000	Oak Creek (Apache Res.), AZ	PIED	1695-1971	Yes	22	11	JSD, RLW
36-2	083099	Spider Rock, AZ	PIED	1601-1971	Yes	34	17	JSD, WJR, DOB, BTB
36-2	081000	Spider Rock, AZ	PSME	1598-1971	Yes	26	13	JSD, WJR, DOB
36-2	091000	Canyon de Chelly, AZ	PSME	1376-1972	Yes	15	10	JSD, WJR, DOB, BTB
36-3	101000	Tseh Ya Kin Canyon, AZ	PSME	1500-1972	Yes	22	11	JSD, WJR, DOB
36-4	433000	Tsegi Point Road, AZ	PIED	1412-1972	Yes	24	12	JSD, DOB
36-4	151000	Betatakin Canyon, AZ	PSME	1263-1970	Yes	30	25	JSD, DOB
36-6	113000	Dinnebito Wash, AZ	PIED	1470-1971	Yes	24	12	JSD, VCL
36-7	183000	Shonto Plateau, AZ	PIED	1365-1971	Yes	24	12	JSD, DOB
36-8	232000	Show Low, AZ	PIPO	1596-1972	Yes	24	12	JSD, DOB
36-9	413000	Jack's Canyon, AZ	PIED	1534-1972	Yes	16	8	JSD, DOB
36-10	212000	Robinson Mtn., AZ	PIPO	1611-1972	Yes	20	10	JSD, DOB
36-10	222000	Medicine Valley, AZ	PIPO	1679-1972	Yes	20	10	JSD, DOB

[1] See Key to Species, page 17.
[2] See Key to Collectors, page 18.

Table II, cont.

Map Reference	ID Number	Site Name	Species	Time Span	Completed	Cores	Trees	Collectors
36-11	402000	White Horse Hills, AZ	PIPO	1659-1972	Yes	14	7	JSD, DOB
36-11	263000	SP Mountain, AZ	PIED	1689-1972	Yes	22	11	JSD, DOB
36-12	312000	Slate Mtn., AZ	PIPO	1648-1971	Yes	20	10	JSD, DOB
36-13	252000	Cross Canyon, AZ	PIPO	1611-1972	Yes	20	11	JSD, WJR
36-13	243000	Defiance Plateau, AZ	PIED	1620-1972	Yes	20	10	JSD, WJR
36-14	393000	Hay Hollow Valley, AZ	PIED	1687-1973	Yes	20	10	JSD
36-15	132000	Navajo Mtn., UT	PIPO	1565-1971	Yes	21	11	JSD, DOB
36-15	133099	Navajo Mtn., UT	PIED	1469-1971	Yes	20	10	JSD, DOB
36-16	123000	Kane Spring, UT	PIED	1445-1971	Yes	20	10	JSD, DOB
36-16	141000	White Canyon, UT	PSME	1347-1972	Yes	28	14	JSD, DOB
36-17	423000	Milk Ranch Point, UT	PIED	1276-1970	Yes	20	10	JSD, WJR
36-19	061099	Bobcat Canyon, CO	PSME	1390-1971	Yes	18	9	JSD, WJR, DOB
36-19	053620	Weatherill Mesa, CO	PIED	1703-1971	Yes	20	10	JSD, WJR, DOB
36-20	071000	Pueblito Canyon, NM	PSME	1643-1972	Yes	24	12	JSD, WJR, DOB
36-20	073000	Pueblito Canyon, NM	PIED	1594-1971	Yes	20	10	JSD, WJR, DOB
36-21	011540	Ditch Canyon Modern, NM	PSME	1660-1971	Yes	22	11	JSD, WJR, DOB
36-21	012000	Ditch Canyon Modern, NM	PIPO	1555-1971	Yes	24	12	JSD, WJR, DOB
36-21	013000	Ditch Canyon Modern, NM	PIED	1575-1971	Yes	22	11	JSD, WJR, DOB

Table II, cont.

Map Reference	ID Number	Site Name	Species	Time Span	Completed	Cores	Trees	Collectors
36-21	014___	Ditch Canyon Modern, NM	JUOS		No			JSD, WJR, DOB
36-22	292000	El Morro, NM	PIPO	1536-1972	Yes	22	11	JSD, WW
36-22	293000	El Morro, NM	PIED	1638-1972	Yes	22	11	JSD, WW
36-23	193000	Mt. Taylor and Canyon Lobo, NM (merged)	PIED	1611-1972	Yes	28	14	JSD, WW
36-24	161000	Satan Pass, NM	PSME	1381-1972	Yes	24	12	JSD, WJR, WW, BTB
36-25	272000	Turkey Spring, NM	PIPO	1595-1972	Yes	26	13	JSD, WJR, WW, BTB
36-25	273000	Turkey Spring, NM	PIED	1411-1972	Yes	20	10	JSD, WW
36-25	283000	Fort Wingate, NM	PIED	1478-1972	Yes	26	13	JSD, WJR, WW, BTB
36-26	303000	Cebolleta, NM	PIED	1662-1972	Yes	32	16	JSD, WW
36-27	323000	Agua Fria, NM	PIED	1490-1972	Yes	23	12	JSD, WW
36-28	332000	Tajique Canyon, NM	PIPO	1691-1972	Yes	24	12	JSD, WJR
36-28	333000	Tajique Canyon, NM	PIED	1656-1972	Yes	22	11	JSD, WJR
36-29	383000	Paliza, NM	PIED	1658-1972	Yes	21	10	JSD, WJR
36-30	171000	Echo Amphitheater, NM	PSME	1362-1972	Yes	24	12	JSD, WJR
36-31	343000	Glorieta Mesa, NM	PIED	1556-1972	Yes	23	12	JSD, WJR
36-32	351099	Ruidosa Ridge, NM	PSME	1690-1972	Yes	20	10	JSD, WJR
36-32	353000	Ruidosa Ridge, NM	PIED	1579-1972	Yes	20	10	JSD, WJR

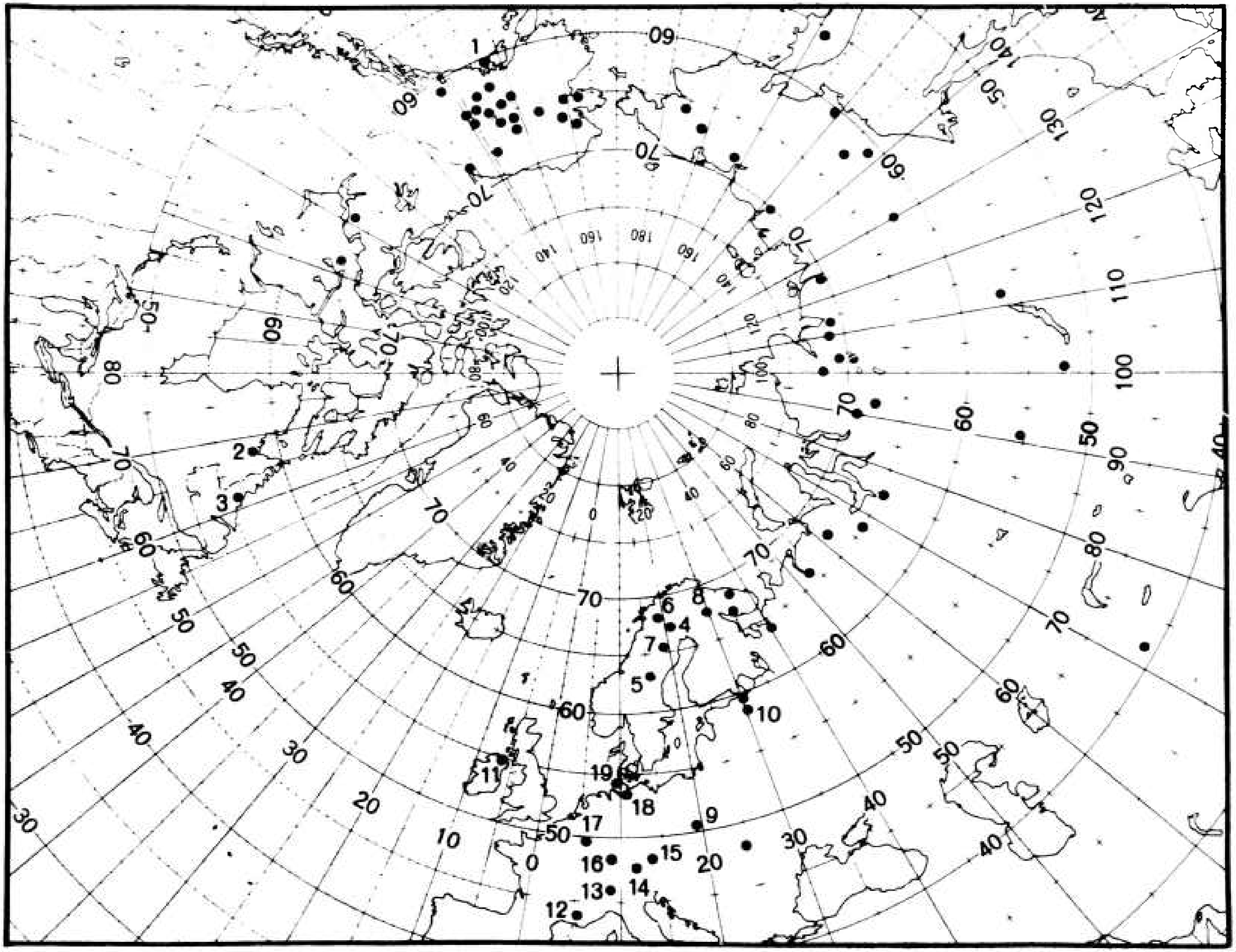

Figure 3. Site localities outside the contiguous United States which (excepting the unnumbered series within the U.S.S.R.) yielded one or more tree-ring chronologies available for dendroclimatic analysis. (See Table III.)

TABLE III

Arctic and European Chronologies

(See Figure 3)

Map Reference	ID Number	Site Name	Species[1]	Time Span	Completed	Cores	Trees	Collectors[2]
1	422889	Herring-Alpine, AK	TSHE	1422-1972	Yes	25	13	HCF, TJS
2	______	Ft. Chimo Site 1-S, Ungava, Canada	PCMA		No			HCF, JT
2	______	Ft. Chimo Site 2-S	PCMA	1700-1974	No			HCF, JT
2	______	Ft. Chimo Site 1-L	LALA	1650-1974	No			HCF, JT
2	______	Ft. Chimo Site 2-L	LALA	1753-1974	No			HCF, JT
2	______	Ft. Chimo Site 3-L	LALA		No			HCF, JT
2	627___	Ft. Chimo Site 4-L	LALA	1641-1974	No			HCF, JT
3	862___	Nain A, Labrador	PCGL	1802-1973	No			HEW
3	861___	Nain B, Labrador	PCGL	1769-1973	No			HEW
4	252778	Muddus Nat. Park and Muddus Site A, Sweden (merged)	PISY	1572-1971	Yes	20	16	BJ, TPH
4	328771	Muddus-2, Sweden	PISY	1532-1972	Yes	41	22	BJ
5	255770	Östersund, Sweden	PISY	1671-1971	Yes	24	12	TPH
6	251779	Arosjak, Sweden	PISY	1614-1971	Yes	24	23	BJ, TPH
7	662770	Arjeplog, Sweden	PISY	1553-1974	Yes	40	20	BJ
8	344777	Lapland, Finland	PISY	1181-1960	Yes			GS

[1]See Key to Species, page 17.
[2]See Key to Collectors, page 18.

Table III, cont.

Map Reference	ID Number	Site Name	Species	Time Span	Completed	Cores	Trees	Collectors
9	622769	Tatra Nat. Park, Poland (pine merged)	PICE	1732-1969	Yes	20	20	ZB
9	624459	Tatra Nat. Park, Poland	PCAB	1766-1965	Yes	10	10	ZB
10	724___	Novgorod Excavations, U.S.S.R	PISY	880-1461	No			BAK
11	QS1000	Belfast, Northern Ireland (historical)	QUSP	1379-1716	Yes	56	56	MB, JP
11	QS2000	Belfast, Northern Ireland (modern)	QUSP	1649-1970	Yes	26	23	MB, JP
11	346003	Northern Ireland (three bogs merged)	PISY	812-1458	Yes	17	17	JP
12	101000	Marseilles, France	PIHA	1807-1973	Yes	21	7	FS
13	401000	Julierpass, Switzerland	PICE	1589-1972	Yes	20	10	AM
13	402000	Mulegns, Switzerland	LADE	1529-1972	Yes	16	8	AM
13	090760	Riederalp, Switzerland	PICE	1769-1967	Yes	10	5	HCF, VCL
14	089769	Patscherkofel, Austria	PICE	1752-1967	Yes	11	8	HCF, VCL
15	626___	Berchtesgaden High Mtns., Federal Republic of Germany	LADE		No			KB
16	878001	Bayerischer Wald, near Zwiesel, Federal Republic of Germany	ABAL	1541-1963	Yes	24	12	BB

Table III, cont.

Map Reference	ID Number	Site Name	Species	Time Span	Completed	Cores	Trees	Collectors
16	880001	Oberer Bannwald, Federal Republic of Germany	PISY	1778-1971	Yes	8	4	BB
16	879001	Schönegründ, Mittleres, Hinterbuch, Federal Republic of Germany	PISY	1769-1971	Yes	14	7	BB
17	290___	Oak West of Rhine, Federal Republic of Germany (modern and archaeological indices)	QUSP		Yes	270	270	EH
18	371827	Hamburg, Federal Republic of Germany	QUSP	1340-1967	Yes	56	56	DE
19	110030	Schleswig, Federal Republic of Germany	PISY	1812-1969	Yes	30	15	DE

C. European Sites

Figure 3 includes tree-ring sites from Eurasia made available to this project. The points shown in western Europe represent 34 sites (Table III) that have evolved out of our ARPA collaboration and the International Workshop on Dendroclimatology held in Tucson on April 15-26, 1974. The 29 points from the Soviet Union are from a map provided by Lovelius of Leningrad representing data that may be available from him. In addition, Professor Bitvinskas reports additional sites which could be made available. However, except for a published work by Kolchin, none of the Soviet Union data has been sent.

An international agreement has been made between the U.S.S.R. and the United States to exchange certain tree-ring programs and data. H. C. Fritts has sent the United States materials several years ago, and a formal letter has now been sent to the U.S.S.R. officials asking if the Soviet scientists still expect to reciprocate. No reply has been received at the time of the writing of this report. We still remain hopeful that an exchange will result, but, as yet, there is no concrete evidence that Soviet scientists will be permitted to send the materials before they are officially published.

IV. VALUE OF COLLECTIONS

Out of a total of 218 or more collections from the Northern Hemisphere, we have developed 127 chronologies, most of them extending to A.D. 1700 or earlier. A total of 100 (or 81%) of these chronologies includes information averaged from 10 or more trees and two replicates per tree.

The dollar value of the North America temperate collections has been estimated using data obtained by Martha Wiseman. She interviewed eight different dendrochronologists at the Laboratory of Tree-Ring Research and solicited estimates of work time and other costs involved in 10 different steps starting with collection and ending with a computer-derived ring-width chronology. For purposes of comparison, all estimates assumed two people were involved in the collecting, 25 trees were sampled by means of two cores per tree, 20 of the 25 trees were dated and processed, and a final chronology was obtained spanning 200 to 300 years. Each person who was interviewed estimated a minimum, average, and a maximum time and expense involved at each stage in the procedure. The mean minimum, mean, and mean maximum values were derived from the eight estimates for each category, and these values are presented in Table IV. One can see that the processing of a chronology of this size requires, on the average, about 152 to 317 person-hours of effort. The greatest percentage of time (33%) is involved in the tedium of working out the dating of the individual rings. Measurement, checking of measurements, and keypunching together consume 31%. All other aspects of the work, including collection and computer analysis, account for the remaining 39%.

These figures were converted to dollar values by using a modest rate of \$5.00/hour for professional staff and \$2.50/hour for nonprofessional staff

TABLE IV

Average Work Time Required to Collect
and Process a 200- to 400-Year Ring-Width Chronology

		Time (in person-hours)[a]			
	Task	Mean Minimum	Mean	Mean Maximum	Mean Percent
1.	Collection[b]	11	15	23	7
2.	Specimen preparation	7	12	17	6
3.	Dating	51	72	120	33
4.	Dating check	10	17	28	8
5.	Measuring	30	39	53	18
6.	Measuring check	20	22	27	10
7.	Keypunching	6	6	7	3
8.	Computer set-up	4	6	8	3
9.	Output check	5	15	19	7
10.	Project supervision	8	11	15	5
	TOTALS	152	215	317	100%

[a]Based upon estimates for each category made by 8 persons, figures rounded to nearest hour.

[b]Assuming collection of 50 cores from 25 trees by 2 persons. Figures include field documentation but not travel time.

and by adding computer and travel costs ranging from $64 to $110 per site. The total costs ranged from an average minimum of $1066 to an average maximum of $2244. The mean amounted to $1492, or roughly $1500 per site chronology.

If the average cost figure of $1500 is multiplied by the 104 final temperate North America chronologies, the worth or replacement value of the ARPA collections amounts to $156,000 or approximately 61% of the dollar amount of the effort. If one adds to this the actual time spent on obtaining and examining collections that did not meet the required specifications for inclusion in one of the mentioned tables and the time expended on the Arctic and European collections, the dollar value of the effort equals or exceeds the total amount of the grant. This is possible because some of the collecting and dating work was carried out by personnel salaried on state funds, by workers salaried on other grants, or by individual donations representing work on unsponsored theses or projects. All the European materials were obtained by nationals and collected using European or personal funds. Some help with dating and measuring and most of the computer processing was accomplished on ARPA funds. Therefore, the ARPA investment has served as very important seed money which yielded a set of ring-width chronologies with value equal to or greater than the value of the original investment.

V. THE INTERNATIONAL PROGRAM

A. The Growing Discipline of Dendroclimatology: A Response to the ARPA-Supported Work

At the time of the first visit to Europe by Fritts in 1968, a respectable number of dendrochronologists were working on problems of tree-ring dating, forestry management, pollution assessments, and related studies, but few were concerned with reconstructing past climate. Only one Scandinavian and a small number of Polish scientists referred to themselves as dendro*climatologists*. After this first visit Fritts began work on a book to describe the science of dendroclimatology including a large part of his and his colleagues' research on the subject. Efforts were also directed at developing scientific methods for large-scale calibration and reconstruction procedures. In addition, letters were sent to a large number of scientists proposing a working group on Northern Hemisphere dendroclimatic analysis. Out of this a list was compiled of approximately 100 seriously interested persons. About 30 of those listed were selected and invited to participate in a workshop on dendroclimatology sponsored by both ARPA and NSF on April 15-26, 1974. This two-week meeting was attended by 27 of the invited scientists and by 30 staff members of the Laboratory of Tree-Ring Research. A number of scientists came early or remained afterwards to work on their own problems with the help of the Tree-Ring Laboratory scientists.

This international workshop was the single most important stimulus to the exponential growth in dendroclimatology that we are experiencing today. The foreign scientists were not only enthusiastic about their firsthand experiences using the technology available at the Laboratory, but they also recognized the many potentialities for more interaction with each other and subsequently established new working relationships. Those staff members of the Laboratory of Tree-Ring Research who had had little prior international contact

were pleasantly surprised by the sincere interest and respect of the visitors for the work of the Laboratory and responded generously providing much assistance, leading discussions, and sharing ideas with the participants. Numerous genuine working relationships evolved, and many of the ARPA staff who are still at the Laboratory continue in one way or another with the international effort.

Another example of the increasing international interest in dendroclimatology resulting from the workshop was a revitalization of the Tree-Ring Society. Foreign members became the new officers although the work of the treasurer remained in Tucson, and our staff serve as editors for the official publication, the *Tree-Ring Bulletin*. An International Tree-Ring Data Bank, which was established at the workshop, is governed by an international committee chaired by Fritts. Karen Babcock McDougall served as Editor of the first Data Bank *Newsletter*. The software development for the Data Bank has begun, and we are now seeking the necessary financial support. The first data have already been received, and we are beginning active solicitation of new contributors and follow-up on past promises. The details of this work are described in the next section.

Another important development is the signing of an agreement between the United States and the U.S.S.R. which includes proposed dendroclimatic collaboration between Fritts (U.S.A.) and Lovelius and Bitvinskas (U.S.S.R.). This agreement was part of a larger document of Working Group VIII on the Influence of Environmental Changes on Climate which was signed in Leningrad in 1974.

Further evidence of the growing interest in this field is the increasing number of the international conferences involving dendroclimatology. In June, 1974, the Mainz Academy of Science and Literature sponsored a symposium on "Dendrochronology of the Post-Glacial--Fundamentals and Developments." Also, the 12th International Botanical Congress held in Leningrad in July, 1975,

included a symposium entitled "Bioecological Principles of Dendrochronology" which was chaired by Fritts. And a tree-ring program is planned for the INQUA Congress to be held in Birmingham, England, in 1977. Details of these and other related projects appear in the following section of this report concerning travels by H. C. Fritts.

At the beginning of 1976, interest and activity in dendroclimatology can be identified with approximately 75 leading scientists (as well as a larger number of collaborating scientists and technicians) in 18 countries throughout the world. These leaders include 31 North Americans, 10 workers from the Soviet Union, 8 West Germans, 6 British, 5 Scandinavians, 4 scientists from the Balkans, 3 Poles, 2 scientists each from Czechoslovakia, Belgium, and France, 1 scientist from Switzerland, and 1 from Israel.

The disciplines represented by these men and women include biology, forestry, meteorology, anthropology, geophysics, astronomy, geology, hydrology, geography, and other related sciences. The Principal Investigator has made an interesting estimate that the current rate at which new dendrochronologists appear is equivalent to one new professional every week and that most of these new workers are interested in, if not directly concerned with, climatic research. While such a growth rate is still small compared to many of the well-established sciences, it is a highly significant development, and it is, in part, a direct consequence of the ARPA-sponsored effort.

B. The International Tree-Ring Data Bank

The continued gathering of tree-ring data from outside the North American continent will be facilitated by the new International Tree-Ring Data Bank which was set up as a part of the ARPA-supported work. The Data Bank offers long-term security of global materials while building an international data

base. Already, contributions of worldwide data have been officially solicited by means of the International Tree-Ring Data Bank *Newsletter*, the first issue of which was published in July, 1975 (see Fig. 4), and two new top-quality chronologies have been received within the past few months. Although lack of financial support at the present time has slowed development of the software for the computerized Data Bank System, the present status of the work is as follows:

1. The organization has been established for the development of the Data Bank System. Included are magnetic tape and microfilm backup facilities and the Data Bank *Newsletter* which is used for general communications to contributors and users of the system. Initially only climate-related samples are being accepted, but there is a provision allowing the flexibility to incorporate other branches of dendrochronology as the opportunity arises. The *Newsletter* is currently received by 21 highly interested European and Asian dendrochronologists and by 30 additional scientists from other geographical areas, mostly North America.
2. The systems definition and programming needs for the Data Bank have been analyzed, and a cost estimate of over $30,000 for two years has been obtained on the basis of the storage of site information, ring-width measurements, and indices, plus the development of a multivariable retrieval system. Also included in the cost estimate is a storage and retrieval system for the climatic reconstructions which will be developed from tree-ring data. Funding for the development of software for the International Tree-Ring Data Bank is still being sought.
3. An official Site Information Sheet, required with all entries into the Data Bank, has been established by the International Tree-Ring Data

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Figure 4

INTERNATIONAL Tree-Ring Data Bank NEWSLETTER

VOLUME 1, NUMBER 1 *JULY, 1975*

With this first *Newsletter* the International Tree-Ring Data Bank officially solicits contributions. The Data Bank and its communication medium, the *Newsletter*, are an outgrowth of discussion among 27 dendrochronologists in an International Workshop on Dendroclimatology held April 15-26, 1974, in Tucson. It was agreed at that time that a central storehouse of tree-ring data from around the world is essential for 1) optimal research data availability, and 2) protection of data from loss due to laboratories which may dissolve and scientists who retire.

The purpose of this *Newsletter* is to keep interested scientists informed on requirements of data entry, listings of data on file, and methods and costs involved in submitting and retrieving data.

The International Tree-Ring Data Bank is *a professional Data Bank* and some discretion on the quality of data entered is essential. Therefore, all contributions to the Data Bank must meet the minimal requirements set forth in this and subsequent issues of the *Newsletter*. All contributions to and inquiries concerning the ITRDB should be addressed to the Data Bank Manager at the above address.

Figure 4, cont.

VOLUME 1, NUMBER 1

SOLICITATION AND REQUIREMENTS FOR DATA

Initial solicitation of Data Bank entries is for climate-related materials, as was agreed in April, 1974. Holdings by the Data Bank, and therefore requirements for entry, will consist of completed Site Information Sheets (copies enclosed), original tree-ring width measurements by individual radius, and standardized indices if they have been provided by the contributor. Indices without ring widths will *not* be included as a part of the official Data Bank. Minimum quality requirements for ring-width measurements to be entered into the Data Bank are that

1) They must have a minimum length of 100 years, but 200- to 300-year length is desirable.
2) There must be a minimum number of 10 trees, per species and site, with two measured radii per tree. For moderate sites 20 or more trees are most desirable.
3) All materials must be calendrically dated and absolutely crossdated within the sample and with other data from the same area. *This is an ABSOLUTE REQUIREMENT.* Please do not send undated material.

It is assumed that the scientist doing the work will be the person supplying the materials. Contributions of other people's work are acceptable if the tree site data, accuracy, and quality can be absolutely verified. Such exceptions should be fully explained in an accompanying letter. Consideration cannot be given to chronologies not meeting these requirements, and in many cases the contributor will want to apply more rigorous requirements.

SITE INFORMATION SHEET

The Site Information Sheet, *required with all data entries*, has been developed and agreed upon by the official Data Bank Committee whose members are listed on the masthead. Members of this committee were selected at the April 1974 meeting. The enclosed version of the Site Information Sheet is for use with samples of living trees. Similar forms for historical, geological, archaeological, densitometric, and other kinds of data entries will be developed

SITE INFORMATION SHEET, continued

and distributed as the ITRDB expands its services and types of holdings. On the S.I. Sheet the contributor is able to designate his data as either available to all Data Bank users or available with his direct permission only. A signature is essential to make this designation valid. Either classification can be changed by the contributor at any time. Please use these S.I. Sheets as printed; more copies are available on request. If the contributor wishes to include site photos and maps with the S.I. Sheet, the Data Bank has the facilities to store and retrieve them.

After using the Site Information Sheet, if you find critically important changes or additions to be made in it, please address suggestions to the Data Bank Manager.

FORMAT OF ENTRIES

For most rapid entry at this time, submission should be on computer cards, using the format specified in the enclosure accompanying this *Newsletter*. At a later date the computer card format will be altered for more efficiency and a new sheet describing format will be sent to Data Bank users via another *Newsletter*. If it is not possible to send data in card form, measurements should be tabulated by radius with clear identification number and decade labelings, to be keypunched at the Laboratory of Tree-Ring Research, preferably at the contributor's expense.

DATA RETRIEVAL PROCEDURES

All contributors may request use of any data held by the Data Bank, and such materials will be made available according to the classification of availability assigned by the contributor and according to the fee schedule

Figure 4, cont.

DATA RETRIEVAL PROCEDURES, continued

yet to be established. Details of data retrieval will be discussed further in later *Newsletters.* While the Data Bank is under development, we will not be able to offer retrieval for noncontributors. Depending upon the speed of development and the rate of contributions, we hope to offer some limited services within a year.

COSTS

No funds have been obtained as yet for the development of the ITRDB, and the Data Bank must eventually become self-supporting. Initially and on a limited basis, for those with no funds but valid data, we can cover the costs if the data are provided in a suitably clear form. User fees will be established on an actual cost basis to cover keypunching, computer costs, and mailing charges.

* * * * *

It is hoped that with care and enthusiasm on the part of contributing dendrochronologists the International Tree-Ring Data Bank will soon become an important source of worldwide tree-ring materials.

Bank Committee, a group of five contributors. Copies of this form were enclosed with the first *Newsletter*.

4. Minimum requirements have been established for data to be entered into the Data Bank. In addition to the requirement of a completed Site Information Sheet, tree-ring samples must:
   a. be replicated and absolutely dated;
   b. have a minimum length of 100 years, but 200- to 300-year length is desirable;
   c. represent a minimum of 10 trees per species and site, hopefully with two measured radii per tree. For temperate sites 20 or more trees are most desirable.
5. Format requirements for contributed data have been established, published, and distributed with the first *Newsletter*.

As of September, 1975, data have been received from Professor Bengt Jonsson of the Royal College of Forestry, Stockholm, Sweden (Arjeplog, Lapland, Sweden; a 422-year chronology) and from Professor Boris A. Kolchin of the Institute of Archaeology, Moscow, U.S.S.R. (Novgorod Excavations, a 582-year chronology). Also, we have invited Dr. Ernst Hollstein, Rheinisches Landesmuseum Trier, Federal Republic of Germany, to place his very valuable and extensive collection in the International Tree-Ring Data Bank. Other European collections cited earlier in this report and the best of the ARPA chronologies will be placed in the Data Bank as soon as we get some sort of funding, formal approval, and site information where these data are now lacking.

C. Report on International Travels (Fiscal Year 1974-75 only)

Two international trips were taken by the Principal Investigator under the auspices of the ARPA project. The first was a collecting trip, taken in

collaboration with Jaan Terasmae of Brock University, St. Catharine's, Ontario, Canada, to Ungava in northeast Canada where collections were obtained in July-August, 1974, from several northern tree-line sites. The details of these collections are described earlier in this text (see Section III, Part B) and in the fifth technical report.

The second trip was begun on June 30, 1975, and included: a) delivery of the manuscript for a book, *Tree Rings and Climate*, to the editor in London, b) participation in the 12th International Botanical Congress in Leningrad, July 3-11, c) visits to three European tree-ring laboratories, and d) participation in the WMO/IAMAP Symposium at Norwich, England, August 17-23.

At the International Botanical Congress, attended by more than 5,000 participants, a half-day symposium entitled "Bioecological Aspects of Dendrochronology" was organized by T. T. Bitvinskas of Kaunas, Lithuanian S.S.R. and chaired by H. C. Fritts, who presented a paper himself entitled "Dendroclimatology." The abstract of that paper follows:

> Variations in the width of tree rings from many temperate climate species can be used to reconstruct past climate. This is possible because growth-controlling processes in the trees are often limited by climatic factors. Some of the unique principles and practices of tree-ring analysis are described, and illustrations are given of applications to a variety of problems of environment and climate. Special mention is made of new multivariate techniques which allow detailed reconstruction and mapping of large-scale variations in past climate from the variations in tree rings of western North America. The current status of reconstructions is summarized, and their possible significance to planning for the future is discussed.

Approximately 60 scientists participated in this symposium. Subsequently, a group of approximately 30 attended a luncheon hosted by the U.S.S.R. Academy of Science where they discussed the possibilities and prospects for international collaboration. This was the first international dendrochronological meeting in the Soviet Union and included workers from approximately seven dendrochronological

laboratories in their country. During the course of the meeting, D. Eckstein (President of the Tree-Ring Society) and H. C. Fritts (Chairman of the symposium) discussed some of the problems related to collaboration and officially invited everyone to join the Tree-Ring Society and the international effort. The Soviet scientists pointed out that the biggest obstacles to their membership involve obtaining U.S. dollars for dues. Also, there was some concern about official approval of membership and their sharing of data by the Soviet Academy of Science. Since that initial discussion, several moves have been made both in the U.S.S.R. and by the U.S. Academy of Science aimed at removing some of the obstacles.

Fritts' visitations in Europe were to 1) Professors Bengt Jonsson and G. Sirén in Stockholm, 2) Dr. F. Schweingruber in Zurich, and 3) Mr. H. B. Schmidt in Cologne. Mr. Schmidt returned the visit with a month-long stay in Tucson during October, 1975, and Dr. Schweingruber is planning a two- to three-month visit in the spring of 1976. Both scientists are working on climatic reconstructions for Europe. During Schmidt's visit we were able to demonstrate significant verification of reconstructions of climate made from German oak rings.

From July 18 to August 17, 1975, during which time Fritts was on annual leave, he visited the following tree-ring scientists: K. Lundstrom in Neuchatel, Switzerland; B. Becker in Stuttgart, Federal Republic of Germany; and E. Hollstein in Trier, Federal Republic of Germany. On return by way of London, Fritts attended the WMO/IAMAP Symposium at the University of East Anglia and presented an informal paper similar to the one given at Leningrad. He also was able to discuss problems in dendroclimatology with other dendrochronologists and climatologists who were attending the meeting.

These travels have been a significant part of the ARPA work not only because of the reports on current work delivered by the Principal Investigator, but also because of numerous discussions and agreements made for future collaboration and interchange. The first portion of this section of the report deals with the larger significance of the travel contacts.

VI. SELECTION AND STATISTICAL CHARACTERISTICS OF THE NEW TREE-RING GRID FROM WESTERN NORTH AMERICAN SITES

Almost all the dendroclimatic analyses since 1967 for western North America have been accomplished using a 49-station grid selected by V. C. LaMarche and edited by Stokes, Drew, and Stockton (1973) in "Tree-Ring Chronologies of Western America, Vol. I. Selected Tree-Ring Stations," *Laboratory of Tree-Ring Research, Chronology Series 1*, University of Arizona, Tucson. Since a variety of new chronologies have become available because of work sponsored by AFOSR 72-2406, we reexamined the available chronologies, selected a new and more extensive set, and analyzed their statistical characteristics. These results and the data from the unpublished chronologies are included in the Appendix.

VII. EVALUATION OF CALIBRATION PROCEDURES

A large portion of our paleoclimatic reconstruction in recent years has involved a large spatial array of climatic variables and tree-ring sites for which eigenvector and canonical analysis were necessary to reduce the number of variables. However, there are still many situations where relatively small data sets are available or where simple relationships may exist for which the conventional multiple regression techniques are more suitable. We decided that a carefully designed test was necessary to evaluate the strengths and weaknesses of the two types of calibration procedures.

A. Data

We were fortunate to obtain precipitation records throughout the western United States from Raymond Bradley of the University of Massachusetts. Many of the records extended back to the late nineteenth century, and all had been screened for homogeneity. Twenty-one of the longest climatic records were selected for stations which could each be matched with nearby tree-ring sites located in Idaho, Wyoming, Utah, and Colorado. The distances between the tree sites and climatic stations ranged from 3 to 97 km, and the differences in elevation ranged from 3 to 949 m. The tree-ring statistics mentioned in the Appendix were compared for the chronologies, and they were ranked from high to low standard deviation and mean sensitivity and from low to high serial correlation. The mean rank was ascertained for each where "1" indicates the greatest amount of climatic information and "21" the least (Table V).

The yearly total precipitation for March through June was calculated for each climatic station for as far back in time as data were available. All tree-ring and climatic data were present in all sets for the years 1909-1960.

TABLE V

Statistics for 10 Tree-Ring Chronologies Which Calibrated Significantly with Spring Precipitation at Nearby Climatic Stations[a]

Pair Number	1	2	3	4	5	6	7	8	9	10
Species	PIED[d]	PIED	PSME[d]	PSME	PIED	PSME	PIPO[d]	PIFL[d]	PSME	PSME
Distance in km between site and station	97	11	43	32	40	11	24	3	13	40
Rank of tree-ring statistics	5	10	3	6	7	4	17	11	1	2
Subscripts of significant coefficients	2,5	3	2	3	2	2	2,4	2	2,3	3
Percent variance calibrated	34	13	36	17	18	42	22	23	51	27
Independent test 1909-1960										
signs +	13	8	12	11	15	15	13	9	13	11
signs -	7	12	8	9	5[b]	5[b]	7	11	7	9
mean positive product	0.65	0.31	2.66	1.44	0.73	2.94[b]	1.21[b]	1.26	2.11[b]	1.36
mean negative product	0.80	0.31	1.70	1.05	0.78	0.81	0.15	1.26	0.7	.62
reduction of error	-0.29	-0.12	-0.09	0.02	0.14	0.40[c]	0.37[c]	-0.17	0.25[b]	0.04
Independent test pre-1909										
signs +	9	3	11	---	18	3	5	---	22	2
signs -	0[c]	1	3	---	6	0	4	---	6[c]	1
mean positive product	1.24	---	4.60[c]	---	0.97	---	0.92[c]	---	3.72	---

(cont.)

Table V (cont.)

Pair Number	1	2	3	4	5	6	7	8	9	10
mean negative product	0.00	--	0.39	--	0.45	--	0.25	--	1.75	--
reduction of error	0.70[c]	--	0.34[b]	--	0.34[c]	--	0.26	--	0.15[b]	--
Verified by independent data	✓		✓		✓	✓	✓		✓	

[a]Preliminary analysis by Shatz (unpublished).
[b]Significant 0.95 level.
[c]Significant 0.99 level.
[d]See Key to Species, page 17.

A total of 32 randomly selected years within this period was used for calibration. The remaining 20 years were set aside to provide an independent data set for testing the calibrations. In addition, all years of climatic data prior to 1909 were also set aside as independent data to provide for additional verification and testing. Calibrations for all 21 sites used data from the same 32 randomly selected years.

B. Methods

Two different empirical statistical models were tested. The first was a multiple regression model to predict precipitation during the spring of year *t* using ring-width indices from the nearby trees for years t-1, t, t+1, t+2, and t+3 as possible predictors. Stepwise regression was used for each of the 21 pairs and terminated when the *F* value for entering a variable was insignificant ($p < 0.95$). Alternative approaches were tested. In one case the growth for year *t* was forced into the regression.

All regression equations with significant coefficients were multiplied by the tree-ring data to statistically estimate (reconstruct) the predictand (climate) for all years of the tree-ring record. These climatic estimates were compared to the actual data for the 20 independent years during the 1909-1960 period and for years prior to 1909 for which there are climatic data.

Three statistics which measure similarity were used to test the reconstructions.

1. The sign test

The sign (+ or -) of the departure of the estimate from the calibration mean is compared with the sign of the actual climatic data departure from the same mean. Each case where both signs are the same is tallied as a plus, and each case of opposite signs is tallied as a minus. The

number of positive cases is compared with the number of negative cases. When more positive signs occur than would likely occur by chance ($p \leq 0.05$), the reconstructions are accepted as significant.

2. Product mean test

The departure of each estimate from the calibration mean is multiplied by the departure of the actual climatic data from the same mean; the positive and negative products are summed separately, and the mean positive and negative products are each obtained. The difference between the two means (m_1 and m_2) is tested (neglecting the sign) with the *t* statistic calculated as

$$t = \frac{m_1 - m_2}{\sqrt{\dfrac{s_1^2}{n_1} + \dfrac{s_2^2}{n_2}}}$$

where s_1^2 and s_2^2 are the corresponding variances and n_1 and n_2 are the numbers of items in each sum. If the value of *t* is higher than the expected value at the 95% confidence level, then the reconstructions are considered to have been verified by statistically significant results.

3. Reduction in error

The third test, which was originally described by Lorenz (1956), is the most rigorous test of the three. The computations are as follows:

$$RE = 1 - \frac{SSR}{SSM}$$

where SSR is the sum of the squares of the differences between actual data and the statistical estimates, and SSM is the sum of the squares of the differences of the actual data from the calibration mean. The

theoretical limits for values of this statistic range from a maximum of +1 (for perfect agreement) to a minimum value of minus infinity. The statistic is tested against the theoretical values expected for the square of a simple correlation coefficient with the same degrees of freedom.

C. Results

The stepwise regression equations for only 10 out of 21 of the paired sets yielded significant regression coefficients. The subscripts of the variables with significant coefficients and the percent variance (R^2 x 100) for the dependent data set are included in Table V. The values for each of the three statistical tests on independent data sets are also tabulated, and the checks at the bottom of the table indicate which calibration equation held up on independent data at the 95% significance level.

Six of the 10 regression estimates were verified by the independent climatic data. The equations for all six of the verified regression estimates utilized coefficients for the ring in year t which was produced in the summer following the particular spring period. Three of the four regressions that did not verify did not include the ring for year t as a predictor. This suggests that chance is involved because of serial correlation in the data so we tried forcing the variable for year t.

It is also apparent from the table that eight out of the 10 sets that had a significant R^2 ranked 10 or higher, of the 21 original sets, in terms of favorable tree-ring statistics (mean sensitivity, serial correlation, and standard deviation [see Appendix]). This verifies that these selected tree-ring statistics can be used to identify chronologies likely to have information on climate.

A comparison of the statistical results as a function of site factors such as differences in elevation and distance between the climatic station and the tree sites did not show any systematic variation. Also, the analysis of logarithms and square roots of the climatic data have been completed, and no significant improvement in the relationship is apparent using these transformations. Analyses using canonical analysis of the 10 climatic records are now in progress. These results also will be tested on independent data in the same fashion as outlined above.

Although the most important comparisons of this study (the comparisons of multiple regression and canonical analysis) are not yet available, the results do show that individual station analyses, at least as run in this analysis for precipitation in the spring and early summer season, can yield calibrations that stand up when tested against independent data. The equations that are verified in the above analyses will now be used to make precipitation reconstructions for comparisons with reconstructions of other parameters such as pressure. This procedure is well adapted for areas where only a small number of tree-ring chronologies are available for climatic calibration and reconstruction. We have applied these techniques to one European case. If personnel and funds are available, the same procedures will be applied to data from eastern North America, the Arctic, and other areas in Europe to begin the compilation of past climatic estimates in those areas where historical measurements of climate are not available.

VIII. SOME SPECIFIC TESTS AND APPLICATIONS

In order to extend the application of dendrochronological techniques to environmental hypotheses developed outside of the Laboratory of Tree-Ring Research, C. Larrabee Winter conducted an experiment suggested by an hypothesis of Mr. Ronald Rosenberg of the U.C.L.A. Space Science Center. Mr. Rosenberg had hypothesized a cycle of reduced precipitation at middle latitudes in North America during years exhibiting high lunar-solar gravitational pull on the earth's atmosphere. Since the period of the lunar-solar tidal cycle is 18.6 years, climatic records, particularly in the western United States, provide a limited experimental sample. Therefore, tree-ring chronologies of several hundred years duration from drought-sensitive trees are an attractive source of proxy precipitation records.

Each chronology in a network of 49 tree-ring sites in western North America was divided into two classes corresponding to tree rings formed during high or low tidal cycle years. We hypothesized that tree-rings formed during a high tidal force year would be different, on the average, from those formed during a low tidal year if there was a relationship. The hypothesis was tested using a t-test for comparison of the mean ring widths for the two tidal classes for each of the 49 tree-ring sites. Only five tree-ring sites showed significantly different means, and a chi-square test shows this result to be within the provision of chance. In the interest of thoroughness, however, the five tree-ring sites with significant t-values were each subjected to a spectral analysis. None of these chronologies showed significant departures at the predicted frequency, 1/18.6 cycles per year, from a general red-noise spectrum. Rosenberg has since refined his hypothesis and predicts reduced

precipitation during high-cycle years only in the Mississippi valley and the eastern United States. Extensive tree-ring sampling would be required in those areas to validate the revised hypothesis.

In a similar vein, corn and wheat production indices provided by James D. McQuigg at the University of Missouri were regressed by Winter against amplitudes of tree growth for the period 1910-1961. The tree-ring amplitudes were derived from the aforementioned 49-station network and formed the set of independent variables. The wheat indices were based upon a weighted average of wheat production in North Dakota, South Dakota, Nebraska, Kansas, and Oklahoma, and it is unclear whether the averaging process provided for differences between winter, spring, and durum wheat. The corn indices were similarly based upon weighted averages of corn production in Iowa, Illinois, Indiana, Ohio, and Missouri. In both cases McQuigg and his associates removed the pronounced technology trend of the last quarter century by means of a multiple regression equation.

The multiple linear regression equations developed by Winter showed a weak, but statistically significant, relationship between both corn and wheat production and tree-ring amplitudes. It is likely that crop production indices defined by state and crop type, particularly in the case of wheat, would show a much stronger relationship to tree growth. Such a relationship could provide a first approximation of the expected frequencies of occurrence of below normal, normal, and above normal grain production in the United States based upon the extended record in tree rings.

Yield data for winter wheat in each state west of the Mississippi were analyzed for anomalies following occurrences of each of the four winter climatic type patterns identified by Blasing (Section XII, No. 4). The results show

easily explainable relationships between patterns of climatic anomaly and patterns of wheat yield anomaly. Since the winter climatic type patterns have already been related to, and can be reconstructed from, spatial patterns of tree-ring width anomaly in western North America, the existing record of harvest data can be reconstructed in the past and the lengthened record used to make probabilistic estimates of what future crop harvests may be. The newly selected tree-ring grids are being recalibrated with climatic data, and when this is complete, we plan to repeat the above experiment.

IX. DEVELOPMENT OF NEW SOFTWARE FOR CLIMATIC ANALYSIS

A. Development of New Software for Batch Processing and Analysis

Two basic data sets are being used extensively in the studies carried out under this and other grants. The first set is monthly precipitation and temperature data for approximately 400 stations in the United States and southwestern Canada. The second set consists of tree-ring indices for sites in the western United States. These data were originally stored on cards, so programs were developed by G. Robert Lofgren to store and facilitate retrieval from magnetic tape. One such program selects a desired set of 80 climatic stations, converts the data to seasonally averaged temperature and precipitation values, and stores the resulting values on another magnetic tape for ready access to other programs which are currently in use and which are described below.

Another computer program was prepared to read each tree-ring chronology set from cards, to test each for continuity, sequential order, and completeness, and to convert each set to acceptable form on magnetic tape. Also, a second versatile program was developed which selects chronologies (or subsets of data within chronologies), reorders them, and writes them in the desired order in formats usable for input data of other programs. These programs are now standard tools used by the entire Laboratory of Tree-Ring Research.

Many analyses of pressure, precipitation, and temperature performed by the dendroclimatic group are best displayed in map form showing geographical patterns in the results. To facilitate easy display a program subroutine was prepared which generates outlines of a map behind the printed climatic data. Maps can be developed for any defined area. For these studies two areas have been defined: 1) the North Pacific, East Asia, and western

North America, and 2) the 48 contiguous United States. The geographical boundaries may be represented by up to four different symbols, while the station locations may utilize a fifth symbol. These subroutines have become an integral part of a variety of programs used throughout the Laboratory.

One particular program normalizes precipitation and temperature data for 80 stations over the United States and southwestern Canada for the modern record of 1899 to 1971, calculates the departures from normal for specified years, and produces a mean anomaly map as well as the range of normalized values for each station for the years selected.

Another computer program was prepared which types seasonal precipitation and temperature patterns over the United States and southwestern Canada in the same manner as Blasing (Section XII, No. 4) typed pressure for half the Northern Hemisphere and prepares a map showing the averaged normalized climatic anomaly for each type.

Another program performs a two-way analysis of variance of both the actual and reconstructed pressure fields over a chosen grid to help identify features of zonality, meridianality, and blocking. Although a shortage of manpower has prevented our using this program, we plan to apply it to the reconstructions of pressure as soon as we finish calibration and reconstructions using the newly formed tree-ring grid.

A program still under development uses monthly temperature and precipitation data according to the response of the tree to climate. We plan to use this program to study how the climate, as the tree "sees it," is related to climatic data outside the area covered by the tree sites. As was the case for the previously mentioned program, our staff members have been focusing on other more pressing work and have not been able to finish this project.

B. Interactive and Text-Editing Capabilities on the DEC-10 Computer

The remote computer terminal (Texas Instruments Model 725) which was provided under this grant has proved to be an extremely useful tool. It has been used in conjunction with the University's DEC-10 computer system for two general classes of work: 1) manuscript preparation, editing, and formatting; 2) the development of interactive programs for various types of operations with dendrochronological data.

1. Manuscript preparation

The University's DEC-10 computer contains two system programs named SOS and ACOLYTE which may be used for working with textual material. SOS is an extremely flexible editing program which is used to enter and/or revise text, and ACOLYTE is a powerful formatting program which arranges the text according to specified format and handles automatic hyphenation. Experience with these programs has shown that they can greatly reduce the total time required to produce a completed manuscript from the original text entry. The entire manuscript for the book *Tree Rings and Climate* was prepared in this manner.

A manual entitled *User's Manual for Texas Instruments Model 725 Terminal and DEC-10 Computer* in preparation by Marna Ares and Emily DeWitt (Section XII, No. 13) describes the use of the terminal for this kind of work.

2. Development of interactive programs

Soon after the acquisition of the terminal, Donald W. Stevens began exploring the potential of interactive programming for manipulating tree-ring data in various ways. As our experience increased, it became apparent that

this type of programming is eminently suited to certain types of operation. The following FORTRAN programs have been developed:

a. SIPP (Site Information Program Package)

SIPP is a group of four linked programs specifically designed for storage, retrieval, and analysis of tree-ring site information. It was conceived as a first step towards the establishment of the International Tree-Ring Data Bank. The four programs allow the following operations:

1) Creation of site information file;
2) Revision of data included in a file;
3) Printing of specified portions of a file;
4) Searching files for specific types of information and performing statistical analysis of the information selected.

SIPP was used for the analysis in the Appendix, and it has been shown to be so flexible and easy to use that the Tree-Ring Laboratory is adopting it for building site information files on all Laboratory chronologies. A SIPP user's manual has been prepared by Donald W. Stevens (Section XII, No. 15) for use by Laboratory personnel.

b. TSCPP (Time Series Comparison Program Package)

This group of programs allows the user to test the crossdating among dendrochronological series. Three different comparison techniques and five ways of transforming the data are available, and the results of a test may be plotted on the terminal. Thus, a user may make repeated runs with a given data set, but different methods, and immediately compare the results.

c. Program RANN

This program generates any desired number of sets of 200 or more normally distributed positive random numbers with user-specified mean and standard deviation. Each set generated is stored in a file in the computer, and a statistical analysis of each set is printed. Such sets of random numbers are used to test a variety of analysis techniques.

d. Program ARBOR

Although the development of the program was not funded by the ARPA grant, the availability of the remote terminal was the primary stimulus.

ARBOR was developed as a teaching tool for use in a course entitled "Biological Basis of Dendrochronology." It is based on a paper entitled "A Computer Model for Cambial Activity" by B. A. Wilson and R. A. Howard in *Forest Science*, Vol. 14, No. 1, 1968, pp. 77-90. ARBOR differs in detail from the model described by Wilson and Howard, but conceptually they are the same. Also, of course, ARBOR is interactive.

Briefly, ARBOR simulates cell growth, division, and differentiation in a single radial file of a growing tree during one growing season and produces output showing the numbers and types of cells, their diameters, wall thicknesses and relative densities, and the ring width as the season progresses. All cambial activity is governed in the model by 22 parameters. Half of these are constants, and the remainder may vary in time. The user must supply values for these parameters, and herein lies the value of ARBOR as a teaching tool. The student is required to find values which will produce reasonable results, and, in the process, gains valuable insight into the conditions which affect the tree's growth.

X. SIGNIFICANCE OF THE WORK PERFORMED UNDER THIS GRANT

The preceding pages of this report have described a many-faceted research effort aimed at stimulating and developing a capacity for dendroclimatic study on a hemispherewide basis.

In the beginning the focus was on the development of new ring-width chronologies. This was particularly advantageous because the ARPA support facilitated the development of chronologies throughout the entire Laboratory of Tree-Ring Research, and the final result was a doubling of the available chronologies in western North America, expansion into eastern North America, and slow, but steady, development of chronologies in the Arctic and in Europe. This chronology development work has been so successful that the value of this new data is significantly greater than the amount of the original ARPA investment.

In addition to the actual collection and development of chronologies, the ARPA project has greatly assisted in the development of worldwide interest in dendroclimatology and in the initiation of collaboration instead of attitudes of competition and isolation which were all too prevalent in past dendrochronological endeavors. The details of these are covered in Section V.

One major effort in part resulting from, but, more importantly, reflecting the value of the ARPA work is the preparation of a book entitled *Tree Rings and Climate* written by the Principal Investigator. This book will be published by Academic Press in London sometime in 1976 and will represent a first concerted attempt to deal with the entire subject of

dendroclimatology. The ARPA project work is referred to and described in various places throughout the book, and the general procedures of climatic reconstruction are developed in a systematic fashion which should further stimulate the international cooperative work. The tables of contents for each chapter of the book are included in Section XIII of this report.

Another major contribution of the overall ARPA support has been the technological development that has resulted. As can be noted from Sections VII through X as well as the list of publications (Section XIII), a variety of techniques have been developed which facilitate the handling of data, the study of relationships, the reconstruction and verification of climatic estimates, and, finally, the application of reconstructions to problems of climate. One important reason for the success of this technological development is that several high-level professional positions at the Laboratory of Tree-Ring Research have been supported through the ARPA contract which has allowed rapid progress in new theoretical and highly technical achievements. It is not an exaggeration to say that the level of continued support for three years has been a major factor in transforming dendroclimatology into a rigorous and sophisticated discipline which now has the capability of solving a variety of important problems involving past and possibly future changes in climate.

XI. PERSONNEL SUPPORTED AT LEAST IN PART BY THIS GRANT

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XII. PUBLICATIONS RESULTING FROM OR HIGHLY RELATED TO THIS GRANT

1. Fritts, Harold C. 1974. Relationships of Ring Widths in Arid-Site Conifers to Variations in Monthly Temperature and Precipitation. Ecological Monographs 44:411-440.*

ABSTRACT

Two multivariate techniques are described which allow one to evaluate ring-width growth and climatic relationships. One technique produces response functions which express in mathematical form the relative effect of monthly temperature and monthly precipitation during a 14-month period on ring-width variations at a given site. Response functions are calculated for 127 coniferous tree sites in western North America. The other technique is a cluster analysis which is used to identify similarities among the response functions and to separate them on the basis of their differences. The climatic factors, precipitation and temperature, for different months vary in their relative importance to ring width. Precipitation is most important and is commonly directly related to growth while temperature is less important and often inversely related to growth. Precipitation is sometimes inversely related to growth and temperature directly related to growth for sites at high altitudes, high latitudes, or on north-facing slopes. Site differences appear to be more responsible for variations in the response functions than species differences, although certain species such as the bristlecone pine have a more or less unique growth response. Suggestions are made as to the physiological and environmental relationships causing the differences. Response functions allow assessment of the effects of certain climatic factors on ring width. The significance of these data and techniques to dendroclimatic analysis and to modeling productivity of forest ecosystems is discussed.

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*Reprints enclosed in reports submitted to ARPA group.

2. Fritts, H. C. and T. J. Blasing. 1974. Tree-Ring Analysis and Its Potential Contribution to the Mapping of Past Climates. Proceedings of the International (CLIMAP) Conference held at Norwich, 17-22 May 1973. Climatic Research Unit, School of Environmental Sciences, University of East Anglia, Norwich, England. Climatic Research Unit Research Publication No. 2.

ABSTRACT

The short length of many climatic records presents a major limitation to the study of climatic change. However, tree-ring widths can be a useful source of climatic information for times before written climatic records were begun. Recent developments have led to the identification of five common types of summer climate in the North Pacific sector and western North America. Occurrences of each type since 1700 A.D. are estimated from ring-width data.

3. Blasing, T. J. and H. C. Fritts. 1975. Past Climate of Alaska and Northwestern Canada as Reconstructed from Tree Rings. In Climate of the Arctic (Proc. 24th Alaskan Science Conf., August, 1973), Gunter Weller and Sue Ann Bowling, eds., Geophysical Institute, University of Alaska, Fairbanks, pp. 48-58.

ABSTRACT

Spatial anomaly patterns of sea-level pressures over North America, the North Pacific, and eastern Asia in the twentieth century can be statistically calibrated with spatial anomaly patterns of tree growth in semiarid western North America. Growth anomalies prior to 1900 were substituted in the calibration equations to reconstruct past circulation features for the eighteenth and nineteenth centuries. The success of the reconstructions for the Arctic was tested against climatic data where possible and against the variations in growth of Arctic trees which respond to variations in climate. Ten different types of tree-growth anomaly patterns were identified in the Arctic between 1800 and 1939. Climatic conditions inferred from the growth anomalies of Arctic trees were compared to circulation anomalies over the Arctic as reconstructed from the arid-site trees to the south. Both of these sources of information were used to infer climatic conditions for the period 1800-1939. Tentative inferences are presented as to climatic conditions for each of five regions in Alaska and northwestern Canada in hope that they may be tested against other lines of evidence.

*Reprints enclosed in reports submitted to ARPA group.

4. Blasing, T. J. 1975. Methods for Analyzing Climatic Variations in the North Pacific Sector and Western North America for the Last Few Centuries. Ph. D. Thesis, University of Wisconsin, 177 pp.

ABSTRACT

The investigation of summer and winter climatic variations in the North Pacific sector and western North America during the last few centuries is the subject of this study. Analysis of monthly mean (sea-level) pressure data in the area of study led to the selection of July and August as the summer months and December, January, and February as winter.

Some multivariate statistical techniques for describing climatic variability are discussed and compared. On the basis of the comparison, a non-orthogonal spatial correlation method is chosen to identify and describe the major types of general circulation, as reflected in anomaly patterns of sea-level pressure, during the twentieth century. Five such anomaly type-patterns are identified for summer and four for winter. These are each associated with an assemblage of generalized weather patterns and a corresponding pattern of temperature and precipitation anomaly in the United States, as well as with a spatial anomaly pattern of tree-ring widths from 49 sites over western North America. The occurrence of one of these ring-width patterns for some year in the past is suggestive of the corresponding occurrence of the associated climatic anomaly type.

Orthogonal eigenvector techniques are then selected for use in the development of a statistical model to estimate departure patterns of sea-level pressure using the ring-width departures as predictor data. The model is first calibrated using available pressure data since 1899. The

model is then applied to estimate winter pressure departure patterns since 1700 A. D. As a means of summarizing these climatic reconstructions, the estimated pressure departure pattern for each winter is compared with each of the type-patterns using correlation coefficients as a measure of comparison. The time series of correlation coefficients between a type-pattern and each winter's estimated departure pattern provides an indicator of the occurrence, or non-occurrence, of the corresponding anomaly type through time. Graphs of the time series of correlation coefficients corresponding to each of the four type-patterns are presented as an indicator of reconstructed winter climatic variations for approximately the last two and one-half centuries.

If an estimated pressure departure pattern is highly correlated with one of the type patterns, the simultaneous occurrence of the temperature and precipitation anomalies associated with twentieth century occurrences of that pressure type-pattern is implicitly specified. These implicit estimates of temperature and precipitation anomaly are then independently verified using available data for the United States from the last half of the nineteenth century. The climatic reconstructions are in good agreement with the recorded data and are found to complement and augment the findings of other investigators.

5. Blasing, T. J. 1974. Linear Statistical Transfer Operators. Presented at the CLIMAP-ARPA-sponsored workshop on transfer functions, Madison, Wisconsin, April, 1974.

ABSTRACT

Advantages and limitations of three multivariate techniques (straightforward multiple regression, regression of orthogonalized variables, and canonical regression) are discussed for various types of applications. All techniques reduce to the same thing (multiple regression) if all variance is preserved. However, variance may be eliminated by eliminating variables in multiple regression or by eliminating transformed variables in the other two approaches. It is in the elimination of unwanted variance (noise) that the three techniques differ. These differences are discussed conceptually so as to aid an investigator in technique selection.

6. Cooper, C. F., T. J. Blasing, H. C. Fritts, Oak Ridge Systems Ecology Group, F. M. Smith, W. J. Parton, G. F. Schreuder, P. Sollins, J. Zich, and W. Stoner. 1974. Simulation Models of the Effects of Climatic Change of Natural Ecosystems. In Proc. of the Third Conf. on the Climatic Impact Assessment Program (CIAP), Feb. 26-Mar. 1, 1974, A. J. Broderick and T. M. Hard, eds., U. S. Dept. of Transportation, Cambridge, Mass.

ABSTRACT

Temperature and precipitation anomalies, suggested as possible manifestations of climatic modification due to supersonic transport aircraft, were used in quantitative biological models to estimate associated anomalies in primary plant production. Anomalies of tree-ring width (a measure of wood production) were estimated at several semiarid sites in western North America. The results indicate that on sites where water stress is likely to be important, a decrease in temperature leads to increased productivity. Estimated increases in ring width of 30% or more are common when the specified temperature anomaly is minus 2 or 3 degrees centigrade.

7. Blasing, T. J. and H. C. Fritts. In Press. Reconstructing Past Climate Anomalies in the North Pacific and Western North America from Tree Rings. Quaternary Research.

ABSTRACT

Winter climatic conditions in the North Pacific sector and western North America are reconstructed back to 1700 A. D. from tree-ring data in western North America via a simple statistical model. The results are verified using climatic data from the last half of the nineteenth century, which is prior to the calibration period of the model. The results are then incorporated into a discussion of the climate of the last half of the nineteenth century. Some aspects of the climatic reconstructions back to 1700 A. D. are also discussed.

8. Clark, N. E., Blasing, T. J., and Fritts, H. C. 1975. Influence of Interannual Climatic Fluctuations on Biological Systems. Nature 256(5515):302-305.

ABSTRACT

Two totally different biological systems, growth patterns of conifers in western North America and the population distribution of albacore tuna along the west coast of North America, respond to interannual changes in their respective environments during different parts of the year. These reactions are linked to the same climatic change signals through large-scale atmospheric flow patterns and air-sea interaction processes. Since the record of one system (tree growth) is longer than that of the second system, variations in the one may be used to estimate values of the second system in the past.

9. Blasing, T. J. 1975. Impacts of Natural Disturbances, Variations in Climate and Man's Activities. Thirteenth Pacific Science Congress, Vancouver, B. C., Canada, August 18-30, 1975.

ABSTRACT

One way to analyze climatic variability is to identify characteristic recurrent large-scale patterns of atmospheric pressure. An analysis of twentieth century data in the North Pacific region led to the identification of four pressure types for winter and five for summer, each type being an average of six highly correlated winter (or summer) pressure departure maps. Those years for which pressure departures were most highly correlated with each type were identified and analyzed to determine associated departure patterns of temperature, precipitation, and cyclone frequency. Associated features of agricultural responses were similarly identified.

The pressure data were calibrated with tree growth (ring width) at 49 stations in western North America, and the calibration was applied to ring-width data from prior to the beginning of the pressure record in order to estimate climatic variations back to 1700 A.D. Analysis of the longer record suggests that some climatic types occurred more frequently, and others less frequently, in the eighteenth and nineteenth centuries than in the twentieth and that, therefore, climatic statistics and probabilities of certain climatic events since 1700 A.D. are different than those computed from twentieth century data only.

10. Blasing, Terence J. 1975. A Comparison of Map-Pattern Correlation and Principal Component Eigenvector Methods for Analyzing Climatic Anomaly Patterns. Fourth Conference on Probability and Statistics in Atmospheric Science, Tallahassee, Florida, November 18-21, 1975. Published by the American Meteorological Society, Boston, Massachusetts, pp. 96-101.

ABSTRACT

A map-pattern correlation method is presented and used to identify four major recurrent type-patterns of winter sea-level pressure anomaly over the North Pacific sector and western North America. These type-patterns are compared with the first five principal component eigenvector patterns derived from the same data. Each type-pattern is found to be essentially a linear combination of two or more eigenvectors. Therefore a type-pattern appears to be a more satisfactory description of a characteristic climatic anomaly pattern than does an individual eigenvector. The role of certain mathematical constraints in principal component analysis is discussed in this context.

11. Fritts, H. C. 1975. Dendrochronology: History from Tree Rings. In "Encyclopaedia Britannica 1976 Yearbook of Science and the Future" (Dave Calhoun, ed.), pp. 196-209. Encyclopaedia Britannica, Chicago, 447 pp.

ABSTRACT

The growth rings of gnarled and weatherworn conifers in the American Southwest have opened vast new possibilities in the study of the earth's environment.

12. Blasing, T. J. and Kutzbach, J. E. In preparation. Relationships of Large-Scale Winter Pressure Patterns to Synoptic Scale Features and to Ring Widths of North American Trees.

ABSTRACT

A map-pattern correlation method identifies major patterns of winter sea-level pressure anomaly over the North Pacific region and western North America. Four major type-patterns are obtained and described in terms of strength or displacement of the Aleutian Low.

Winters featuring the best examples of each pressure type are analyzed for anomalies in ring widths and for characteristic synoptic features and associated anomaly patterns of temperature and precipitation in the conterminous United States. Anomalous frequencies of weather sequences (including the "Krick-Elliott" weather types) are found to characterize winters of each pressure type, and to be related to the specific patterns of tree growth. The results are consistent with previously published studies of anomalies in ring-width patterns and the response of trees to variations in climate.

13. Ares, Marna and DeWitt, Emily. In preparation. User's Manual for Texas Instruments Model 725 Terminal and DEC-10 Computer, Laboratory of Tree-Ring Research, University of Arizona, Tucson.

ABSTRACT

The Laboratory of Tree-Ring Research uses the Texas Instruments Model 725 terminal as a tool in manuscript preparation and text editing. In terms that can be understood by the neophyte, the manual discusses details of the operation of the terminal, the usage of the interactive DEC-10 computer system, and the implementation of systems text-editing and formatting programs. Storage of information on computer disk and tape and printing of files are among other procedures described.

14. Stevens, Donald. 1975. Program ARBOR User's Manual, Laboratory of Tree-Ring Research, University of Arizona, Tucson.

ABSTRACT

This user's manual describes the model and parameters, and provides instructions for using ARBOR, an interactive FORTRAN program for use on the DEC-10 computer system. ARBOR is designed as a teaching tool for use by students in the Tree-Ring Laboratory. The program simulates cell growth, division, and differentiation in a single radial file of cells in a growing tree during a single growing season. The model requires the user to supply values for several parameters which control the operation, and by varying these parameters the user may determine their effects on the development. Included is a set of predetermined parameters which may be used for demonstration purposes.

15. Stevens, Donald. 1976. SIPP User's Manual, Laboratory of Tree-Ring Research, University of Arizona, Tucson.

ABSTRACT

This user's manual describes the program operations and provides instructions for the use of SIPP, a group of interactive FORTRAN programs for use on the DEC-10 computer system by members of the Tree-Ring Laboratory. These programs are designed to handle tree-ring site information and enable the user to perform the following functions: 1) create site information data files; 2) edit such files; 3) print all or selected portions of the files; 4) search files for specific information and perform certain statistical operations on the data selected.

16. Fritts, H. C. In press. Tree Rings and Climate. Academic Press, London.

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CHAPTER 7. CALIBRATION

CHAPTER 8. INTERPRETATION OF CLIMATIC CALIBRATIONS, RECONSTRUCTION, AND VERIFICATION

CHAPTER 9. RECONSTRUCTING SPATIAL VARIATIONS IN CLIMATE

17. Stevens, Donald. In press. A Computer Program for Simulating Cambial Activity and Ring Growth. *Tree-Ring Bulletin*.

ABSTRACT

This paper describes an interactive computer program which simulates daily cell growth and differentiation in a single radial file of tree cells. The growth processes are controlled by 22 model parameters, half of which are constants, the remainder time-dependent. The program user specifies the constants and the form of the time variations desired. The program computes daily values for the time-dependent parameters, and applies these values to the calculation of cell diameters, cell division, cell-wall thickness, and ring width for each day of the growing season. Output is in tabular and graphical form. The tabular listing consists of the cell diameter at each position in the radial file, and for the xylem it also prints cell-wall thickness and a relative density for each cell. The graphical output plots cell diameter, wall thickness, and relative density vs. file position. The program was designed primarily as an instructional tool and has been used for this purpose with good results. Because of its flexibility it has potential for research, and some possibilities for such use are discussed.

18. Fritts, H. C. and Shatz, D. J. In press. Selecting and Characterizing Tree-Ring Chronologies for Dendroclimatic Analysis. Tree-Ring Bulletin.

ABSTRACT

A widely spaced grid of tree-ring chronologies most suitable for dendroclimatic analysis of western North America is selected objectively on the basis of 1) numbers in the sample, length in years, and site locations, 2) statistical characteristics of the chronologies, and 3) correlation of chronologies with those on neighboring sites. The chronology statistics are then analyzed to characterize the quality of the selected set. The procedures used in this study are recommended for future climatic analysis to assure objectivity in the selection of quality tree-ring data and to allow comparisons of the statistics for new chronologies to the established data sets.

TREE-RING CHRONOLOGIES
FOR DENDROCLIMATIC ANALYSIS
An Expanded Western North American Grid

Linda G. Drew, Editor

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with

Introduction

by

H. C. Fritts and D. J. Shatz

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Many of the techniques first employed by V. C. LaMarche, Jr., in selecting the original 49 chronologies have been utilized in this work. Acknowledgement is also given to the original work of the collectors and their part in providing the basic statistics for the study, as well as the help of Donald W. Stevens in recalculating the statistics by means of his SIPP program.

This volume was produced using the facilities of the University Computer Center. Staff members of that facility were especially helpful and courteous.

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I. INTRODUCTION AND CHRONOLOGY STATISTICS

A large number of dendroclimatic studies since 1967 have used a set of 49 chronologies from western North America, referred to as the 49-site network, which were originally selected by V. C. LaMarche, Jr. and published in the first of a new chronology series (Stokes *et al.*, 1973). Due to three years of continuing ARPA support (AFOSR 72-2406) as well as other grants (NSF Grant GP-4640. NPS Contract CX700050241, NPS Contract 2101-L2-1679, and NSF Grant SOC 73-05490-AOZ), a large number of new tree-ring collections have become available from western North America. Therefore, David J. Shatz reexamined approximately 600 data sets listed in the Inventory of Chronologies at the Laboratory of Tree-Ring Research as updated on August 28, 1974, to select candidates for a revised network.

The best of the available chronologies were chosen from climatically sensitive sites covering the same general region as the original 49-site network. The candidates had the following characteristics:

1. The chronologies were derived from measured ring widths of a single species sampled from specific site localities. The samples usually included 10 or more trees with two replications from opposite sides of the stem of each tree making a total of at least 20 radii (cores) for some portion of the derived chronology. The sites were selected in such a way as to obtain the best spatial distribution. In areas where coverage was poor and where no better candidates were available, samples of fewer than 10 trees and 20 cores were accepted.
2. All materials were carefully dated, measured, and computer processed to obtain mean standardized ring-width indices (see Fritts, in press).
3. All candidates began in the year 1700 or earlier and ended after 1963.

4. While the sample sizes, aerial distributions, and chronology lengths were utilized in selecting the candidates, often there was a surplus of minimally qualified chronologies in the well-collected areas.

In order to maintain uniform coverage of chronologies throughout the entire grid and to maximize chronology quality, the following screening procedures were used. Four statistics of the chronologies were compared, and the respective chronologies were ranked in terms of their suitability for use in climatic reconstruction. The "best" chronologies were assumed to have: a) highest mean sensitivity (a statistic measuring relative year-to-year ring-width variability, b) lowest first-order serial correlation (autocorrelation), c) highest standard deviation, and d) highest percent variance in the mean yearly values of the chronology (see Fritts, in press). Only the first three statistics were available for all cases.

The area covered by the selected set of candidates was divided into a number of geographic regions varying in size and including from 10 to 20 of the highest-ranking chronology sites. The sizes of the regions were arbitrary and usually depended upon geography and the number of high-ranking candidates available. Each of the high-ranking chronologies was treated with a high-pass digital filter (Fritts, in press) which created a new time series with most of the chronology variance at wavelengths from two to eight years but without the lower frequencies. Each was also treated with a low-pass digital filter which created another time series with most of the chronology variance at wavelengths ranging from eight years to infinity but without the higher-frequency variance (Stockton and Fritts, 1971).

Three different correlation analyses were performed on the 10 to 20 chronologies of each region using 1) the unfiltered indices of the original chronologies, 2) the high-pass filtered components, and 3) the low-pass filtered components. In each analysis, correlation coefficients were obtained for all combinations of the set of 10 to 20 chronologies, and the means of correlation coefficients associated with a given chronology were used to assess the similarities of that chronology to others in the same region (Stockton and Fritts, 1971). When a site was near the margins of two or more of the selected regions, the chronology was analyzed as a part of each region. The mean correlations for the unfiltered and the two filtered sets, the amount of variance measured in the high- and low-frequency components, and the ratio of high-frequency to low-frequency variance were used in the final selection.

The rationale for the method is based on the principle that the more climate is limiting to the trees of a given region, the better the correlation among chronologies at all frequencies. However, the more nonclimatic factors unique to a particular site are highly limiting, the more the low-frequency variance and the less the correlation of the low-frequency component with those of neighboring sites (Fritts, in press). Thus, disturbance from site factors such as fire, disease, and cutting is indicated by a low correlation of the low-frequency variance of the particular chronology with the variance in chronologies from neighboring sites. In addition, the ratio of high-pass to low-pass variance is less.

Correlations among chronologies can also be low if the trees on neighboring sites have responded to different climatic factors (LaMarche, 1974a) or if the climatic signal varied because of the distance or difference

in microclimates of the two sites. In such cases, both of the correlation coefficients for the high-frequency and the low-frequency variances will be proportionately reduced. Exceptions to the above are the temperature-sensitive chronologies at high elevations that are generally characterized by much larger amounts of low-frequency variance than high-frequency variance (LaMarche, 1974a), and the low frequency variance is highly correlated from one site to the next because it is the result of variations in climate (see LaMarche, 1974b).

Therefore, the final selected chronologies include the largest and longest available samples providing the best available spatial coverage over western North America. They also are chronologies with the highest mean sensitivities, standard deviations, and percent variances in the mean chronology, and the lowest serial correlations. In addition, they are those with the highest correlations with neighboring chronologies for both the low-frequency and the high-frequency components and include the highest ratios of high-frequency to low-frequency variance.

The final selections include a total of 102 chronologies. The site name, collector, identification number, species, location, elevation, and the most important available characteristics are included in Table I. Numbers 1 through 40, shown as triangles in Figure 1, represent all the chronologies which began in the years prior to and including A.D. 1500; numbers 41 through 65, shown as open circles in Figure 1, are those beginning in the years A.D. 1501 through 1600, inclusive; numbers 66 through 89, shown as solid circles, are those chronologies beginning in the years A.D. 1601 through 1700, inclusive. An additional thirteen chronologies, from 90 through 102

TABLE I

Characteristics of the 102 Selected Chronologies Including Site Name, State, Country, Collectors, Identification Number, Species, and Other Characteristics

PAVILION LAKE BRC CAN H.C. FRITTS
071540 PSME* 1 5050N 12141W 1158M 486Y 1480:1965 20C SR: .29 SD: .39 MS: .39
AZ:158 SL:23 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 1

KAMLOOPS BRC CAN H.C. FRITTS
526547 PSME 2 5045N 12033W 822M 546Y 1420:1965 20C SR: .25 SD: .33 MS: .34
AZ:180 SL:25 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 1

NARAMATA BRC CAN C.W. FERGUSON & M.L. PARKER
064649 PIPO 3 4936N 11935W 609M 551Y 1415:1965 12C SR: .22 SD: .32 MS: .34
AZ:225 SL: 5 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 1

POWERHOUSE ALB CAN C.W. FERGUSON & M.L. PARKER
057540 PSME 4 5112N 11531W 1432M 556Y 1410:1965 20C SR: .43 SD: .33 MS: .30
AZ:999 SL:99 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

EXSHAW ALB CAN C.W. FERGUSON & M.L. PARKER
525547 PSME 5 5107N 11522W 1371M 506Y 1460:1965 40C SR: .43 SD: .35 MS: .33
AZ:225 SL:45 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 1

BOULDER CREEK, WINTHROP WA USA C.W. FERGUSON & M.L. PARKER
066640 PIPO 6 4835N 12010W 701M 498Y 1468:1965 20C SR: .58 SD: .26 MS: .20
AZ:999 SL:99 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 5

LAKEVIEW OR USA M.L. PARKER
034640 PIPO 7 4206N 12034W 1828M 544Y 1421:1964 20C SR: .58 SD: .22 MS: .16
AZ: 67 SL:25 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 1

DELL MT USA C.W. & E.B. FERGUSON
018590 PIFL 8 4439N 11246W 2194M 655Y 1311:1965 20C SR: .45 SD: .41 MS: .40
AZ:270 SL:30 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 1

SPRINGDALE MT USA C.W. FERGUSON & M.L. PARKER
053599 PIFL 9 4543N 11014W 1371M 544Y 1422:1965 19C SR: .34 SD: .34 MS: .34
AZ:999 SL:99 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 5

GARDINER MT USA C.W. FERGUSON & M.L. PARKER
052540 PSME 10 4500N 11042W 1706M 521Y 1445:1965 20C SR: .49 SD: .39 MS: .32
AZ:270 SL:30 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 5

DEAD INDIAN HILL WY USA C. FERGUSON & D. DESPAIN
315547 PSME 11 4445N 10920W 2133M 672Y 1300:1971 19C SR: .58 SD: .28 MS: .37
AZ:270 SL:25 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

GROS VENTRE & UHL HILL WY USA C.W. FERGUSON
552590 PIFL 12 4342N 11031W 2179M 572Y 1400:1971 24C SR: .58 SD: .38 MS: .24
AZ:180 SL:45 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

WIND RIVER 'D' WY USA HARSHA, STOCKTON & JACOBY
283590 PIFL 13 4305N 11004W 2499M 481Y 1492:1972 20C SR: .51 SD: .27 MS: .20
AZ:245 SL:30 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

ELBOW CAMPGROUND WY USA C.W. FERGUSON & M.L. PARKER
051549 PSME 14 4313N 11047W 1981M 476Y 1490:1965 32C SR: .58 SD: .36 MS: .28
AZ:999 SL:99 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

LARAMIE 'A' WY USA M.A. STOKES & T.P. HARLAN
108549 PSME 15 4106N 10605W 2591M 521Y 1444:1964 16C SR: .42 SD: .49 MS: .47
AZ:999 SL:99 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 5

NEW NORTH PARK CO USA M.A. STOKES & T.P. HARLAN
110549 PSME 16 4055N 10620W 2468M 611Y 1354:1964 21C SR: .51 SD: .39 MS: .33
AZ:180 SL:25 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 1

*See Key to Species, page 11.

Table I, cont.

EAGLE EAST CO USA M.A. STOKES & T.P. HARLAN
113629 PIED 17 3940N 10643W 2164M 651Y 1314:1964 22C SR: .39 SD: .30 MS: .29
AZ:180 SL:20 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 1

SALIDA CO USA M.A. STOKES & T.P. HARLAN
504547 PSME 18 3829N 10556W 2194M 637Y 1328:1964 13C SR: .33 SD: .37 MS: .38
AZ:360 SL:35 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 1

ANTONITO CO USA M.A. STOKES & T.P. HARLAN
530547 PSME 19 3704N 10611W 2621M 668Y 1298:1965 29C SR: .41 SD: .48 MS: .47
AZ:180 SL:22 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 1

BOBCAT CANYON CO USA DEAN, ROBINSON & BOWDEN
061099 PSME 20 3710N 10831W 2042M 582Y 1390:1971 18C SR: .27 SD: .42 MS: .45
AZ: 45 SL:45 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

SCHULMAN OLD TREES, MESA VERDE CO USA SCHULMAN, NICHOLS & SMITH
532547 PSME 21 3712N 10830W 2103M 514Y 1450:1963 34C SR: .21 SD: .47 MS: .58
AZ:360 SL:45 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 1

NINE MILE CANYON (HIGH) UT USA M.A. STOKES & T.P. HARLAN
123549 PSME 22 3947N 11018W 1920M 771Y 1194:1964 20C SR: .44 SD: .45 MS: .42
AZ: 90 SL:41 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 1

LA SAL MTNS, SITE A UT USA J.B. HARSHA & C.W. STOCKTON
285620 PIED 23 3830N 10915W 2323M 484Y 1489:1972 18C SR: .41 SD: .35 MS: .34
AZ: 0 SL: 0 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

KANE SPRINGS UT USA J.S. DEAN & D.O. BOWDEN
123000 PIED 24 3732N 10954W 1966M 527Y 1445:1971 20C SR: .36 SD: .35 MS: .35
AZ: 70 SL:10 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

WHITE CANYON I. UT USA J.S. DEAN & D.O. BOWDEN
141008 PSME 25 3737N 11001W 1859M 494Y 1479:1972 20C SR: .44 SD: .41 MS: .38
AZ:345 SL:55 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

NAVAJO MOUNTAIN UT USA J.S. DEAN & D.O. BOWDEN
133099 PIED 26 3701N 11051W 2286M 503Y 1469:1971 20C SR: .22 SD: .41 MS: .49
AZ:270 SL:45 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

WATER CANYON UT USA M.A. STOKES & T.P. HARLAN
130629 PIPO 27 3740N 11206W 2000M 629Y 1336:1964 18C SR: .52 SD: .26 MS: .22
AZ:999 SL:99 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 4

HILL 10842, SNAKE RANGE NV USA V. LAMARCHE & C. FERGUSON
027519 PILO 28 3857N 11413W 2926M 1967Y 1:1967 12C SR: .37 SD: .28 MS: .27
AZ:180 SL:30 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 3

CHARLESTON PEAK, H-17 SAD NV USA C.W. FERGUSON
042510 PILO 29 3617N 11538W 3048M 999Y 966:1964 14C SR: .46 SD: .32 MS: .26
AZ:999 SL:99 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 3

SUSANVILLE CA USA H.C. FRITTS
760008 PIPO 30 4029N 12033W 1828M 479Y 1485:1963 24C SR: .48 SD: .34 MS: .29
AZ:999 SL:99 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 3

LOG CABIN MINE, TIOGA PASS CA USA C.W. FERGUSON
048579 PIJE 31 3757N 11909W 2590M 661Y 1304:1964 25C SR: .54 SD: .24 MS: .19
AZ:225 SL:27 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 3

WHITE MOUNTAINS CA USA E. SCHULMAN & H.C. FRITTS
995517 PILO 32 3725N 11810W 3108M 1164Y 800:1963 44C SR: .24 SD: .35 MS: .40
AZ:202 SL:37 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 1

SAN GORGONIO CA USA R. TOSH
323598 PIFL 33 3406N 11650W 3048M 2012Y -42:1970 32C SR: .55 SD: .25 MS: .20
AZ:999 SL:99 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

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SOUTHERN CALIFORNIA                              CA   USA   C.W.FERGUSON
524520 PSMA  34 3403N 11705W 1402M  509Y 1458:1966  38C SR: .45 SD: .41 MS: .41
AZ:360 SL:35 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 1

WALNUT CANYON NATL MONUMENT                      AZ   USA   M.A. STOKES & T.P. HARLAN
182649 PIPO  35 3512N 11131W 2072M  520Y 1447:1966  26C SR: .36 SD: .43 MS: .47
AZ:  0 SL: 0 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 1

BETATAKIN CANYON I.                              AZ   USA   SCHULMAN, DEAN & BOWDEN
151099 PSME  36 3641N 11032W 2042M  471Y 1500:1970  20C SR: .33 SD: .47 MS: .52
AZ:340 SL:35 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

DEFIANCE WEST                                    AZ   USA   M.A. STOKES & T.P. HARLAN
158540 PSME  37 3552N 10926W 2133M  492Y 1474:1965  18C SR: .40 SD: .45 MS: .46
AZ:270 SL:18 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 1

SATAN PASS                                       NM   USA   DEAN BOWDEN ROBINSON, BURNS
161000 PSME  38 3536N 10808W 2286M  592Y 1381:1972  24C SR: .46 SD: .61 MS: .57
AZ:335 SL:30 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

ECHO AMPHITHEATER I.                             NM   USA   ROBINSON, BURNS & DEAN
171099 PSME  39 3621N 10631W 2042M  611Y 1362:1972  20C SR: .41 SD: .56 MS: .49
AZ: 25 SL:35 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

SAN PEDRO MARTIR (LOW)                           BAJ  MEX   STOKES, HARLAN & CLEMANS
337579 PIJE  40 3100N 11525W 2133M  523Y 1449:1971  41C SR: .28 SD: .28 MS: .29
AZ:999 SL:25 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

KAMLOOPS                                         BRC  CAN   H.C. FRITTS
070640 PIPO  41 5045N 12033W  822M  376Y 1590:1965  20C SR: .49 SD: .32 MS: .28
AZ:180 SL:25 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 1

PYRAMID LAKE                                     ALB  CAN   C.W. FERGUSON & M.L. PARKER
527547 PSME  42 5254N 11805W 1219M  426Y 1540:1965  36C SR: .39 SD: .39 MS: .36
AZ:180 SL:15 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 1

UNION                                            OR   USA   M.L.PARKER
033640 PIPO  43 4509N 11737W 1432M  400Y 1565:1964  20C SR: .51 SD: .24 MS: .18
AZ:135 SL:40 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 1

PAULINA                                          OR   USA   M.L. PARKER
037640 PIPO  44 4416N 11953W 1311M  375Y 1591:1965  20C SR: .60 SD: .28 MS: .21
AZ:999 SL:99 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 5

KETCHUM & WARM SPRINGS                           ID   USA   C.W. FERGUSON
535549 PSME  45 4344N 11419W 1829M  445Y 1521:1965  26C SR: .50 SD: .30 MS: .24
AZ:999 SL:99 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

SALMON RIVER SOUTH                               ID   USA   C.W. & E.B. FERGUSON
020540 PSME  46 4458N 11357W 1402M  397Y 1569:1965  16C SR: .27 SD: .34 MS: .34
AZ:315 SL:45 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 1

HELENA                                           MT   USA   C.W. & E.B. FERGUSON
016540 PSME  47 4643N 11148W 1127M  401Y 1565:1965  18C SR: .36 SD: .48 MS: .50
AZ:202 SL:30 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 1

LIVINGSTON                                       MT   USA   C.W. FERGUSON & M.L. PARKER
054549 PSME  48 4536N 11033W 1433M  434Y 1532:1965  26C SR: .33 SD: .32 MS: .32
AZ:999 SL:99 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 5

PILGER MTN. LOOKOUT                              SD   USA   H.C. FRITTS
146649 PIPO  49 4328N 10354W 1402M  445Y 1520:1964  19C SR: .61 SD: .39 MS: .33
AZ:360 SL:15 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 1

ALCOVA RESERVOIR,A                               WY   USA   M.A. STOKES & T.P. HARLAN
104640 PIPO  50 4231N 10644W 1859M  421Y 1544:1964  20C SR: .48 SD: .34 MS: .30
AZ:360 SL:20 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 1
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Table I, cont.

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OWL CANYON                                           CO    USA    H.C. FRITTS & R.L. HOLMES
533009 PIED  51 4048N 10511W [illegible]9M  435Y 1530:1964  20C SR: .45 SD: .33 MS: .32
AZ: 90 SL:20 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 1

HORSETOOTH SUMMIT                                    CO    USA    H.C. FRITTS & R.L. HOLMES
522009 PSME  52 4034N 10512W 2072M  385Y 1580:1964   8C SR: .32 SD: .31 MS: .29
AZ: 22 SL:33 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 1

CLARK MOUNTAIN                                       CA    USA    C. FERGUSON & P. MEHRINGER
085650 ABCO  53 3532N 11535W 2195M  373Y 1596:1968  10C SR: .38 SD: .38 MS: .40
AZ:360 SL:45 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 3

DINNEBITO WASH I.                                    AZ    USA    J.S. DEAN & V.C. LAMARCHE
113099 PIED  54 3610N 11030W 1920M  405Y 1567:1971  22C SR: .40 SD: .47 MS: .50
AZ:999 SL:10 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

DEFIANCE EAST                                        AZ    USA    M.A. STOKES & T.P. HARLAN
159640 PIPO  55 3550N 10907W 2316M  412Y 1554:1965  16C SR: .33 SD: .50 MS: .57
AZ:  0 SL: 0 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 1

SHOW LOW                                             AZ    USA    J.S. DEAN & D.O. BOWDEN
232000 PIPO  56 3415N 10949W 2073M  377Y 1596:1972  24C SR: .56 SD: .55 MS: .52
AZ: 25 SL:35 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

SANTA CATALINA MTNS                                  AZ    USA    T.P. HARLAN
139549 PSME  57 3225N 11046W 2773M  443Y 1526:1968  23C SR: .54 SD: .34 MS: .26
AZ:360 SL:30 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

DITCH CANYON                                         NM    USA    DEAN, ROBINSON & BOWDEN
012000 PIPO  58 3700N 10749W 2073M  417Y 1555:1971  24C SR: .51 SD: .40 MS: .36
AZ:135 SL:15 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

EL MORRO I.                                          NM    USA    J.S. DEAN & W. WOOLFENDEN
292099 PIPO  59 3502N 10821W 2225M  437Y 1536:1972  22C SR: .44 SD: .55 MS: .56
AZ: 45 SL:25 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

TURKEY SPRINGS                                       NM    USA    DEAN WOOLF'N ROB'SON, BURNS
272000 PIPO  60 3524N 10831W 2477M  378Y 1595:1972  26C SR: .45 SD: .51 MS: .53
AZ:295 SL:30 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

RAINY MESA                                           NM    USA    C.W. STOCKTON
194000 PSME  61 3335N 10835W 2741M  448Y 1520:1967  20C SR: .34 SD: .37 MS: .36
AZ: 90 SL:30 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 2

WOFFORD LOOKOUT                                      NM    USA    M.A. STOKES & T.P. HARLAN
529547 PSME  62 3259N 10542W 2773M  451Y 1515:1965  13C SR: .49 SD: .34 MS: .29
AZ:360 SL: 4 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 1

ORGAN MOUNTAINS                                      NM    USA    STOKES, NAYLOR & HARLAN
014549 PSME  63 3221N 10633W 2499M  374Y 1597:1970  12C SR: .27 SD: .31 MS: .29
AZ:999 SL:99 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 2

SIERRA DEL NIDO 'B'                                  CHI   MEX    T.H. NAYLOR
269547 PSME  64 2931N 10649W 2286M  403Y 1569:1971  11C SR: .37 SD: .32 MS: .30
AZ:360 SL:60 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 6

SIERRA MADRE/EL SALTO WEST                           DUR   MEX    STOKES, HARLAN & HOLMES
531547 PSME  65 2320N 10536W 2621M  374Y 1592:1965  36C SR: .43 SD: .20 MS: .18
AZ:180 SL:15 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 1

PIPESTONE CANYON                                     WA    USA    C.W. FERGUSON & M.L. PARKER
067540 PSME  66 4825N 12003W  914M  267Y 1700:1966  20C SR: .51 SD: .36 MS: .29
AZ:999 SL:99 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 5

BUTTE                                                MT    USA    C.W. FERGUSON & M.L. PARKER
021540 PSME  67 4550N 11221W 1676M  278Y 1688:1965  14C SR: .29 SD: .44 MS: .45
AZ:999 SL:99 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 5
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SPANISH CREEK                                   MT   USA   FERGUSON, DESPAIN & HOUSTON
317540 PSME  68 4527N 11118W 1829M  349Y 1623:1971  20C SR: .33 SD: .36 MS: .36
AZ:999 SL:99 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

PEDRO MOUNTAINS 'A'                             WY   USA   M.A. STOKES & T.P. HARLAN
106640 PIPO  69 4222N 10651W 2188M  355Y 1610:1964  14C SR: .38 SD: .25 MS: .24
AZ:999 SL:99 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

BIG THOMPSON                                    CO   USA   H.C. FRITTS & R.L. HOLMES
492000 PSME  70 4025N 10517W 1890M  265Y 1700:1964  20C SR: .25 SD: .40 MS: .43
AZ:360 SL:45 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

ESCALANTE FORKS                                 CO   USA   M.A. STOKES & T.P. HARLAN
119620 PIED  71 3840N 10820W 1859M  325Y 1640:1964  20C SR: .22 SD: .34 MS: .38
AZ:999 SL:99 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 4

UINTA MOUNTAINS 'C'                             UT   USA   STOCKTON, HARSHA & JACOBY
279540 PSME  72 4034N 10957W 2286M  337Y 1635:1971  18C SR: .55 SD: .40 MS: .34
AZ:315 SL:45 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

BIG WASH EAST                                   NV   USA   C.W. FERGUSON & M.L. PARKER
043630 PIMO  73 3853N 11410W 2103M  353Y 1612:1964  20C SR: .26 SD: .35 MS: .38
AZ:135 SL:18 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 1

LITTLE WHISKEY FLAT                             NV   USA   C.W. FERGUSON & M.L. PARKER
030630 PIED  74 3813N 11840W 2256M  351Y 1614:1964  20C SR: .39 SD: .57 MS: .61
AZ:999 SL:99 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 3

MT. TRUMBULL 'A' & TUWEEP                       AZ   USA   M.A. STOKES & T.P. HARLAN
521629 PIED  75 3628N 11308W 1798M  345Y 1620:1964  16C SR: .41 SD: .37 MS: .35
AZ:999 SL:99 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

SPIDER ROCK                                     AZ   USA   DEAN ROBINSON BOWDEN, BURNS
083099 PIED  76 3606N 10921W 1890M  371Y 1601:1971  34C SR: .30 SD: .40 MS: .44
AZ:360 SL:30 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

MEDICINE VALLEY                                 AZ   USA   J.S. DEAN & D.O. BOWDEN
222000 PIPO  77 3524N 11135W 2190M  294Y 1679:1972  20C SR: .38 SD: .43 MS: .44
AZ: 20 SL:33 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

S. P. MOUNTAIN I.                               AZ   USA   J.S. DEAN & D.O. BOWDEN
263099 PIED  78 3535N 11139W 2042M  284Y 1689:1972  20C SR: .42 SD: .46 MS: .46
AZ:270 SL:10 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

GRASSHOPPER                                     AZ   USA   J.S. DEAN & R.L. WARREN
022000 PIPO  79 3404N 11035W 1798M  330Y 1642:1971  28C SR: .50 SD: .47 MS: .48
AZ:360 SL: 5 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

ALPINE                                          AZ   USA   C.W. STOCKTON
191000 PSME  80 3354N 10908W 2743M  302Y 1666:1967  20C SR: .40 SD: .45 MS: .46
AZ:999 SL:99 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 2

NANTAK GAP                                      AZ   USA   T.P. HARLAN & M.L. PARKER
165540 PSME  81 3318N 10945W 2027M  317Y 1650:1966  20C SR: .44 SD: .34 MS: .29
AZ:999 SL:99 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 2

CLARK PEAK SADDLE                               AZ   USA   T.P. HARLAN & K. SCHWAB
189540 PSME  82 3241N 10959W 2682M  338Y 1630:1967  18C SR: .49 SD: .34 MS: .30
AZ:  0 SL: 0 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 2

SANTA RITA (HIGH)                               AZ   USA   STOKES, HARLAN & FELLOWS
179540 PSME  83 3143N 11051W 2438M  322Y 1645:1966  18C SR: .52 SD: .32 MS: .26
AZ:999 SL:99 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 2

PUEBLITO CANYON                                 NM   USA   DEAN, ROBINSON & BOWDEN
071000 PSME  84 3642N 10720W 2073M  329Y 1643:1971  24C SR: .31 SD: .51 MS: .51
AZ:360 SL:30 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976
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Table I, cont.

FOX MOUNTAIN NM USA C.W. STOCKTON
193000 PSME 85 3402N 10845W 2713M 340Y 1628:1967 20C SR: .34 SD: .38 MS: .36
AZ:180 SL:30 NOTES: PUBL. IN: PAPERS OF THE LAB. OF TREE-RING RES., #5, 1975

SIERRA MADRE/RANCHO ESCONDIDO CHI MEX STOKES, HARLAN & HOLMES
534647 PIPO 86 3010N 10815W 2133M 336Y 1630:1965 38C SR: .25 SD: .32 MS: .34
AZ:360 SL:25 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 1

BIG BEND/ BOOT SPRINGS TX USA M.A. STOKES & T.P. HARLAN
155540 PSME 87 2915N 10318W 1981M 335Y 1631:1965 14C SR: .38 SD: .58 MS: .57
AZ:360 SL:29 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 1

SIERRA DEL CARMEN COA MEX C.W. STOCKTON & M.A. STOKES
271540 PSME 88 2856N 10237W 2042M 297Y 1675:1971 16C SR: .50 SD: .38 MS: .34
AZ:999 SL:99 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

SIERRA MADRE/TRES RIOS CHI MEX STOKES, HARLAN & HOLMES
167649 PIPO 89 3020N 10830W 2347M 330Y 1636:1965 21C SR: .27 SD: .30 MS: .29
AZ:999 SL:99 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

TURKEY CREEK AZ USA T.P. HARLAN & M.L. PARKER
163620 PIED 90 3323N 10947W 1859M 267Y 1700:1966 20C SR: .43 SD: .37 MS: .33
AZ:999 SL:99 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 2

CIENEGA AZ USA M.L. PARKER & T.P. HARLAN
164640 PIPO 91 3318N 10944W 1890M 306Y 1661:1966 20C SR: .38 SD: .26 MS: .25
AZ:999 SL:99 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 2

ROSE PEAK AZ USA M.A. STOKES & T.P. HARLAN
162640 PIPO 92 3223N 10922W 2316M 306Y 1660:1965 14C SR: .57 SD: .47 MS: .36
AZ:999 SL:99 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 2

OAK CREEK (APACHE RES.) AZ USA J.S. DEAN & R.L. WARREN
033000 PIED 93 3403N 11040W 1707M 277Y 1695:1971 22C SR: .44 SD: .34 MS: .32
AZ:315 SL:30 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

SALT RIVER DRAW AZ USA J.S. DEAN & R.L. WARREN
042000 PIPO 94 3403N 11039W 1817M 295Y 1677:1971 20C SR: .61 SD: .58 MS: .51
AZ:315 SL: 7 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

CROSS CANYON AZ USA J.S. DEAN & W.J. ROBINSON
252000 PIPO 95 3540N 10920W 2195M 362Y 1611:1972 22C SR: .46 SD: .41 MS: .39
AZ:360 SL: 0 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

DEFIANCE PLATEAU AZ USA J.S. DEAN & R. L. WARREN
243000 PIED 96 3542N 10922W 2134M 353Y 1620:1972 20C SR: .40 SD: .44 MS: .47
AZ:999 SL: 5 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

SPIDER ROCK, CANYON DE CHELLY AZ USA J.S. DEAN & W.J. ROBINSON
081000 PSME 97 3606N 10921W 1890M 375Y 1598:1972 26C SR: .52 SD: .41 MS: .36
AZ:360 SL:30 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

CANYON DE CHELLY AZ USA J.S. DEAN & W.J. ROBINSON
091000 PSME 98 3606N 10923W 1829M 597Y 1376:1972 15C SR: .48 SD: .29 MS: .25
AZ:315 SL:35 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

ROBINSON MTN. I. AZ USA J.S. DEAN & D.O BOWDEN
212000 PIPO 99 3524N 11132W 2225M 362Y 1611:1972 20C SR: .32 SD: .37 MS: .39
AZ:360 SL: 3 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

LUNA NM USA M.A. STOKES & T.P. HARLAN
176640 PIPO 100 3351N 10901W 2332M 273Y 1693:1965 14C SR: .52 SD: .47 MS: .43
AZ:999 SL:99 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 2

LUNA, SAN FRANCISCO R. WATERSHED NM USA C.W. STOCKTON
192000 PSME 101 3350N 10900W 2591M 302Y 1666:1967 20C SR: .41 SD: .38 MS: .36
AZ:360 SL:15 NOTES: PUBL. IN "TREE-RING CHRONOLOGIES OF WESTERN AMERICA", VOL 2

CEBOLLETA I. NM USA J.S. DEAN & W. WOOLFENDEN
303099 PIED 102 3455N 10750W 2134M 311Y 1662:1972 20C SR: .26 SD: .41 MS: .42
AZ:270 SL:45 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

Key to Species for
Tables I and III and the Chronologies

Abbreviation	Common Name	Scientific Name
ABCO	white fir	*Abies concolor*
PIED	Colorado pinyon	*Pinus edulis*
PIFL	limber pine	*Pinus flexilis*
PIJE	jeffrey pine	*Pinus jeffreyi*
PILO	bristlecone pine	*Pinus longaeva*
PIMO	singleleaf pinyon	*Pinus monophylla*
PIPO	ponderosa pine	*Pinus ponderosa*
PSMA	big cone spruce	*Pseudotsuga macrocarpa*
PSME	Douglas-fir	*Pseudotsuga menziesii*

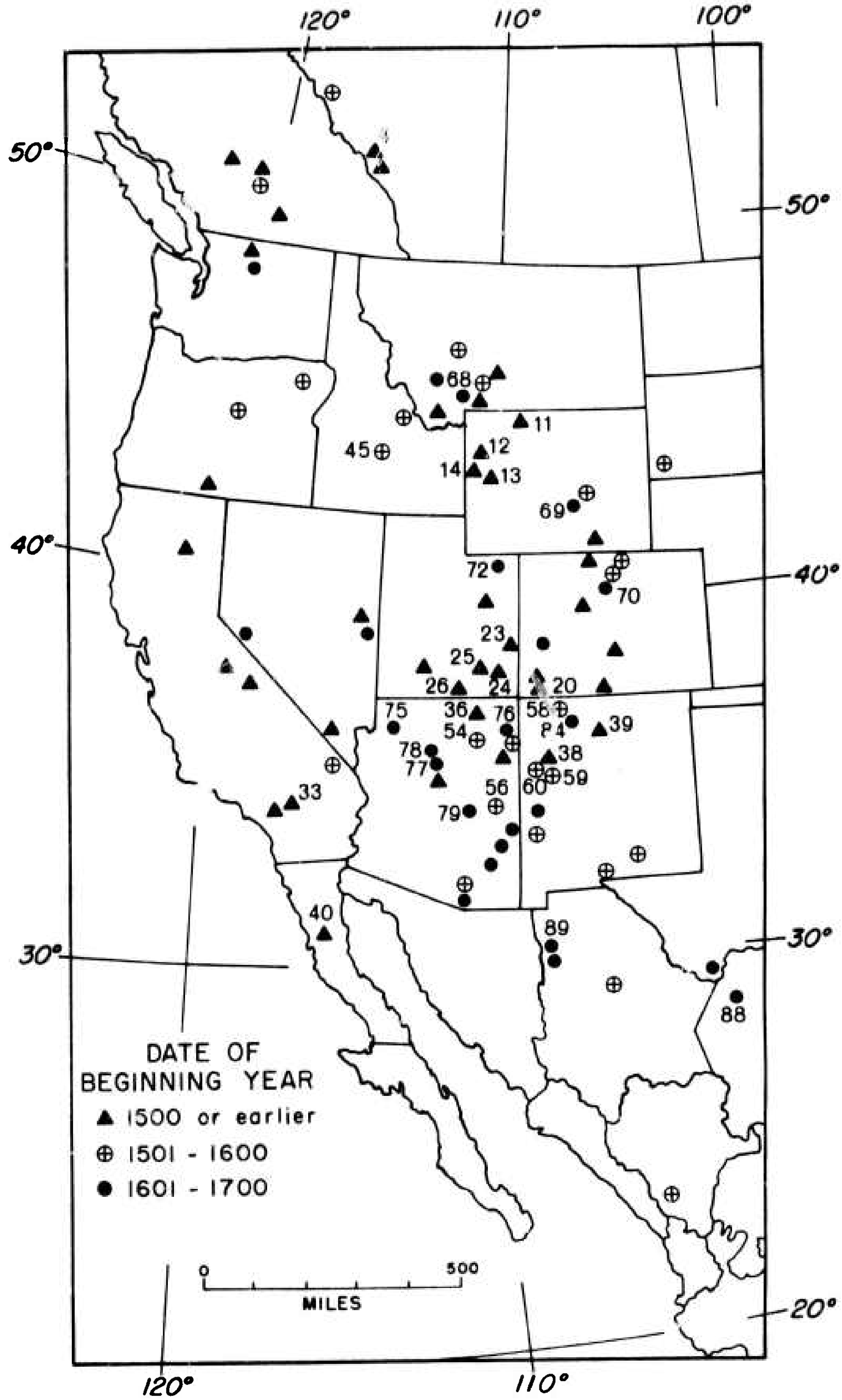

Figure 1. A map of sites selected to obtain the 89-chronology grid. Numbers indicate the new chronologies published for the first time in this volume and correspond to the numbers in Table I and to the numbers associated with the chronological date shown at the end of the report.

in Table I, are included to provide a dense grid for chronologies in and around the state of Arizona. In addition to these, the Arizona network includes 47 of the first 89 chronologies, making a total of 60 chronologies.*

This arrangement allows easy use of the data for climatic analysis. Any of the four sets may be selected depending upon what is needed. The longest set of 40 chronologies does not cover western North America as well as the shorter and larger sets (Fig. 1). The entire 65-chronology set has a somewhat more uniform distribution, but some chronologies begin as late as A.D. 1600. The 89-grid set is denser but is continuous to only A.D. 1700. The remaining 60-chronology set selected for Arizona is the most dense, but it provides the least spatial coverage.

The depth of the chronologies (number of trees used) has been improved over those of the 49 set published in 1973. For the earlier set only 59% of the chronologies that were included were from samples of 10 or more trees, while for the 40-, 65-, and 89-chronology sets the percentages of sites with more than 10 trees are 72%, 69%, and 69% respectively. We are gratified with this improvement but hope to raise the percentages to at least 90%. The reason for these low percentages is that a number of the original under-sized chronologies from the 49-site set had to be reused. This situation will not be fully remedied until field parties can return to the areas collected earlier, either to obtain new and larger chronologies or to update, enlarge, and lengthen the original limited-sized collections. The effort to increase the chronology depth also will be facilitated if, in the future, collectors will increase the amount and quality of material they sample before leaving a site.

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*The numbers of these chronologies in Table I are: 17-28, 33-40, 53-64, 71, 73, 75-86, 89-102.

In order to evaluate and document the statistics of these new data sets, the statistics of the chronologies (Table I) were examined by stratifying them into different subsets, then obtaining for each stratified subset the mean, median, maximum, and standard deviation for 1) mean sensitivities, 2) first-order serial correlations, 3) standard deviations, and 4) chronology lengths. The standard deviations and means were used to calculate the 50% theoretical limits of the population ($\pm$ 0.67 standard deviation) and the 95% theoretical limits ($\pm$ 2 standard deviations) for the four statistics (Stevens, 1976).

Table II includes selected data for the chronologies stratified into numbers 1 through 40, numbers 41 through 65, numbers 66 through 89, and numbers 90 through 102. The mean lengths of the chronologies shown at the bottom of the table range from 655 years for the 1 through 40 set to a mean of 323 years for the 66 through 89 set. The averages of mean sensitivities, serial correlations, and standard deviations are similar for the first two sets. The chronologies 66 through 89 exhibit, on the average, higher mean sensitivities, 0.390, higher standard deviations, 0.397, but lower serial correlations, 0.379. Chronologies 90 through 102 have somewhat lower mean sensitivities than the 66 through 89 set and higher serial correlations and standard deviations than the other three sets. The standard deviations are not greatly different among the four sets, so that the 50% and 95% upper and lower limits are governed largely by the means of each statistic.

These data indicate that there are no great differences in the statistical characteristics of the four sets. While the first 40 chronologies form the longest and most continuous set, the coverage is poor so that the tree rings may not include the climatic variations occurring in the spatial voids of the set. The coverage is improved somewhat by adding the chronologies 41 through

TABLE II

Summarization of Characteristics for the
Entire Data Set Stratified into Groups Representing Differences
In the Three Length Classes and the Additions to the Arizona Grid
(Chronologies are Identified by Their Number in Table I)

		Length Classes			Arizona Grid
Characteristic		1-40	41-65	66-89	90-102
Mean Sensitivity	Mean	0.355	0.352	0.390	0.372
	Standard Deviation	0.107	0.116	0.096	0.076
	Upper 50% Limit	0.427	0.430	0.455	0.424
	Lower 50% Limit	0.283	0.273	0.326	0.321
	Upper 95% Limit	0.568	0.583	0.582	0.525
	Lower 95% Limit	0.142	0.120	0.198	0.220
Serial Correlation	Mean	0.415	0.433	0.379	0.446
	Standard Deviation	0.112	0.096	0.098	0.097
	Upper 50% Limit	0.490	0.498	0.445	0.512
	Lower 50% Limit	0.340	0.368	0.312	0.381
	Upper 95% Limit	0.638	0.626	0.575	0.640
	Lower 95% Limit	0.192	0.240	0.182	0.252
Standard Deviation	Mean	0.370	0.371	0.397	0.400
	Standard Deviation	0.086	0.092	0.081	0.082
	Upper 50% Limit	0.428	0.433	0.451	0.456
	Lower 50% Limit	0.311	0.309	0.342	0.344
	Upper 95% Limit	0.543	0.556	0.558	0.565
	Lower 95% Limit	0.197	0.187	0.235	0.235
Chronology Length (yrs.) Mean		655	409	323	337

65 so that spatial variations in growth throughout the West may be better represented. The chronologies 66 through 89 do not substantially increase the coverage, and they decrease the length of continuous coverage of the entire set. However, the statistics of this latter group indicate better dendroclimatic quality and, therefore, may provide the best, as well as the largest, set for any analyses not requiring complete tree-ring information for the sixteenth and seventeenth centuries. A question has been raised that too many of the chronologies 66 through 89 may be located near the center of the network so that the most central chronologies may dominate, decreasing the importance and usefulness of those at the boundaries of the grid. Research is underway to test this possibility and to measure the total information in each of the four sets.

Since no major differences in statistics exist, the 89 chronologies were pooled and stratified first by species (Table III, Fig. 2), by latitude (Fig. 3), and by elevation (Fig. 4). In the latter two classifications all species were pooled and stratified and then stratified again by species. Only the results for Douglas-fir (*Pseudotsuga menziesii*--PSME) are shown in Figures 3 and 4.

The 11 pinyon (*Pinus edulis*--PIED) in the 89-chronology set exhibited higher average mean sensitivities and lower average serial correlations than the 44 Douglas-fir and the 21 ponderosa pine (*Pinus ponderosa*--PIPO). It may be inferred from these results that, on the average, the pinyon chronologies exhibited the "best" dendroclimatic statistics indicating that they contained the most information on climatic variations. The ponderosa pine chronologies, on the average, exhibited the poorest statistics and, therefore, appear to have the least information on climatic variations. However, there is considerable

TABLE III

Summarization of Characteristics of the Three Major Species Included in the 89 Selected Chronologies

Characteristic		Species PIED*	PSME*	PIPO*
Mean Sensitivity	Mean	0.412	0.376	0.348
	Standard Deviation	0.097	0.096	0.131
	Upper 50% Limit	0.477	0.441	0.437
	Lower 50% Limit	0.347	0.311	0.260
	Upper 95% Limit	0.605	0.568	0.611
	Lower 95% Limit	0.219	0.184	0.086
Serial Correlation	Mean	0.361	0.400	0.452
	Standard Deviation	0.079	0.097	0.116
	Upper 50% Limit	0.414	0.465	0.531
	Lower 50% Limit	0.307	0.335	0.374
	Upper 95% Limit	0.520	0.593	0.685
	Lower 95% Limit	0.202	0.207	0.220
Standard Deviation	Mean	0.395	0.393	0.366
	Standard Deviation	0.079	0.082	0.105
	Upper 50% Limit	0.448	0.448	0.436
	Lower 50% Limit	0.342	0.337	0.295
	Upper 95% Limit	0.553	0.557	0.575
	Lower 95% Limit	0.238	0.228	0.156
Number of Chronologies		11	44	21

*See Key to Species, page 11.

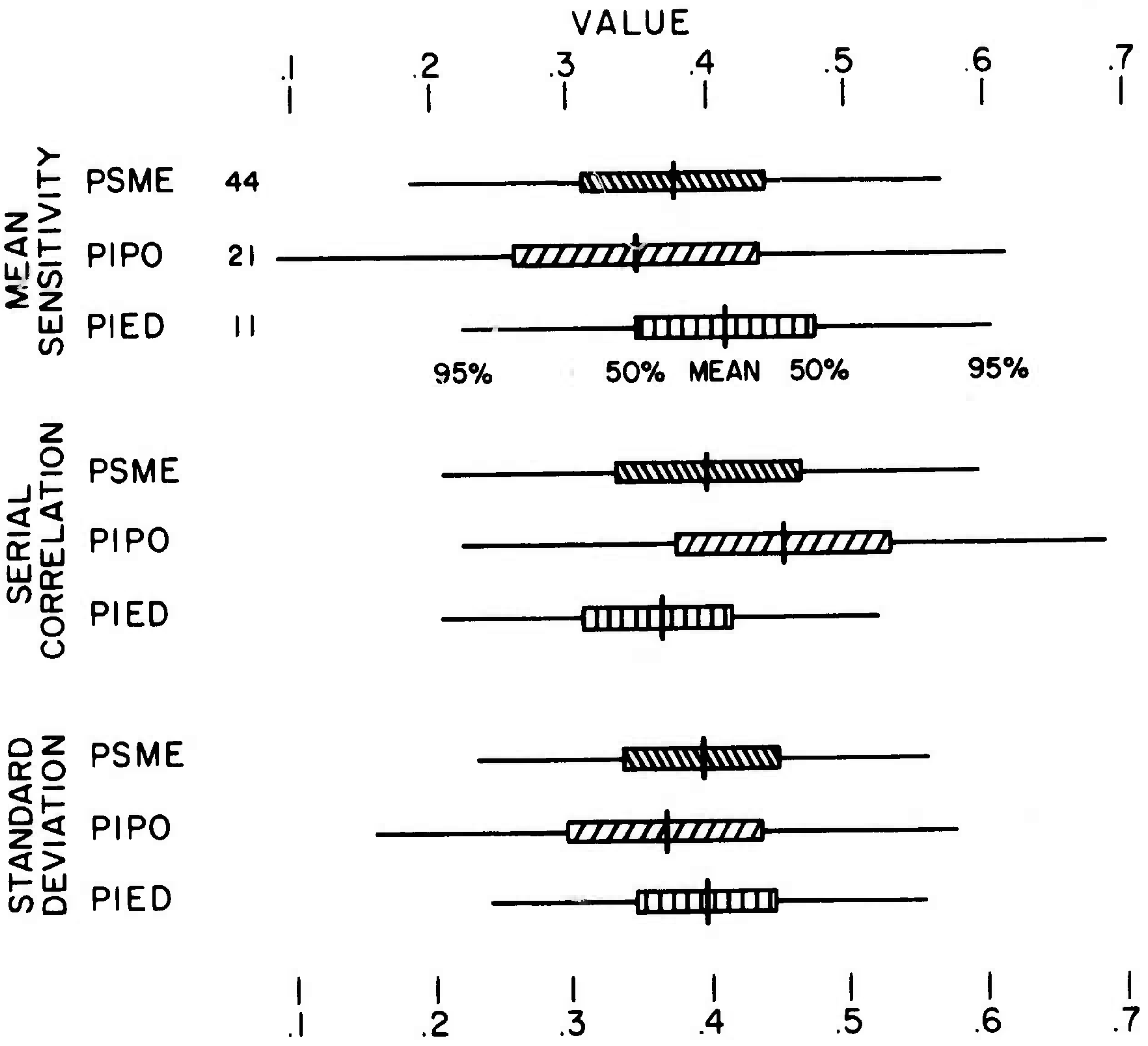

Figure 2. The means, the 50% ranges, and the 95% ranges of three statistics for the 89 chronologies stratified according to species. The numbers for each of the species are shown in the upper left.

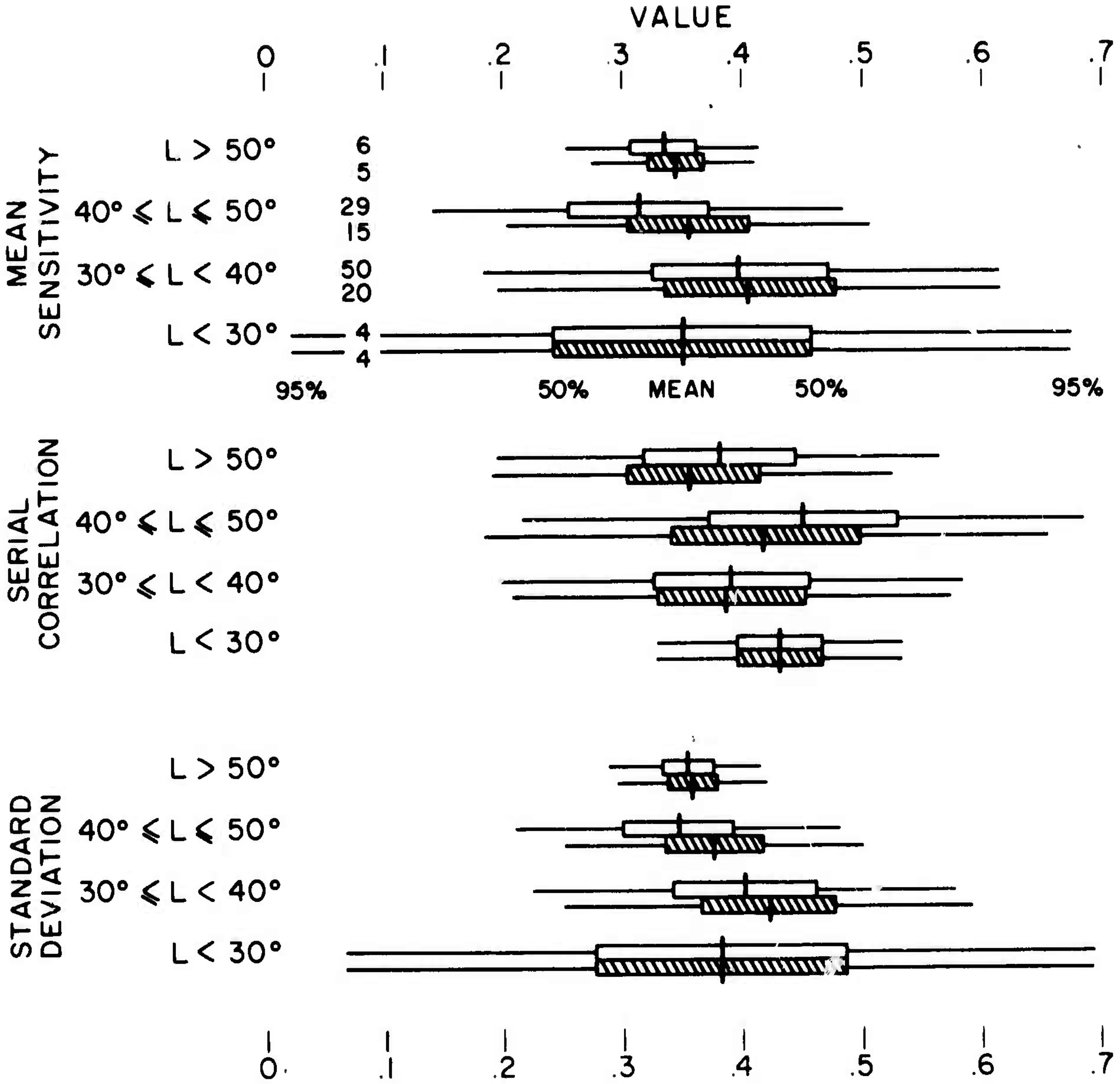

Figure 3. The means, the 50% ranges, and the 95% ranges of three statistics for the 89 chronologies stratified according to latitude for all species (open bars) and for Douglas-fir (hatched bars). The numbers in each of the classes are shown in the upper left.

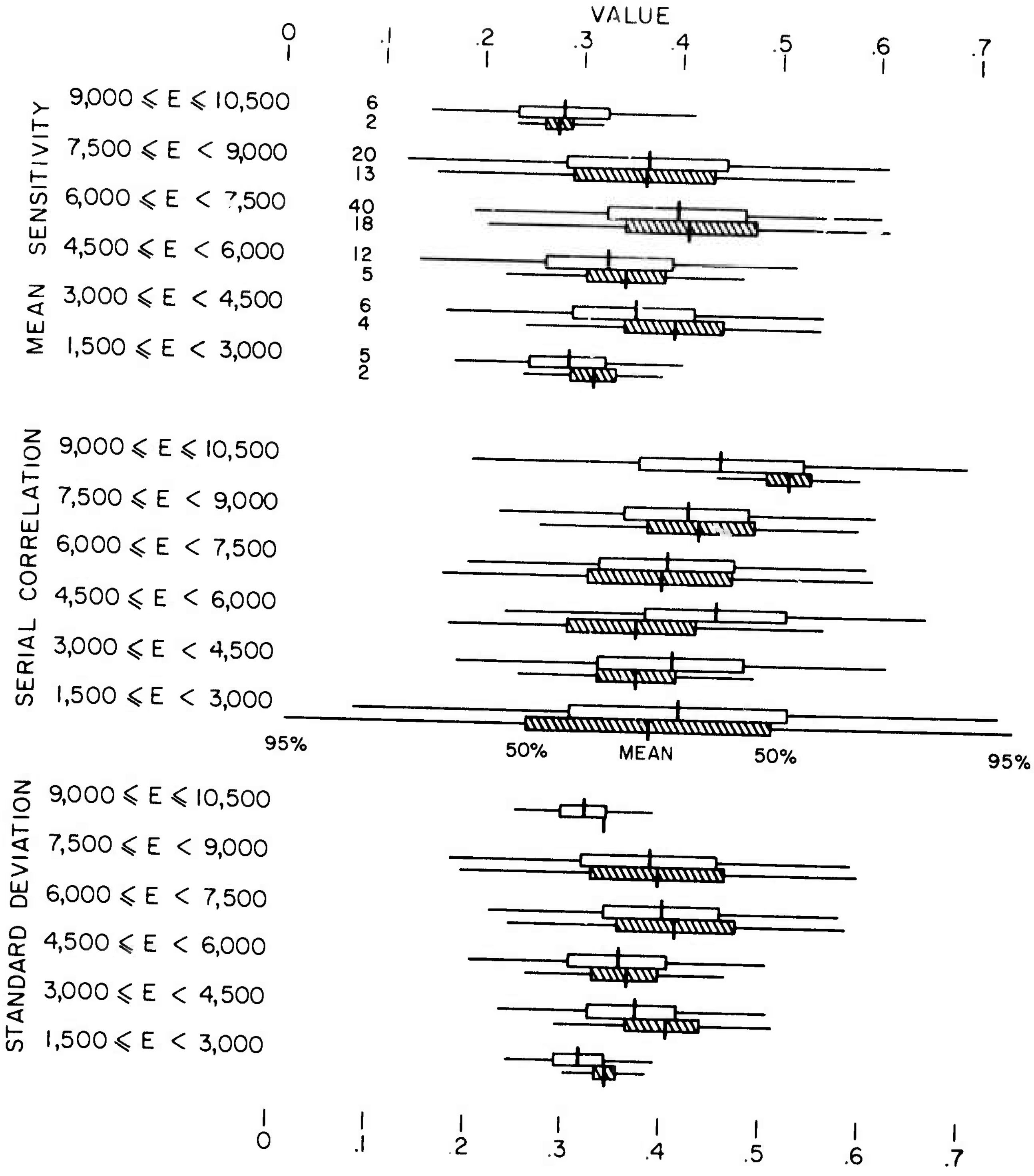

Figure 4. The means, the 50% ranges, and the 95% ranges of three statistics for the 89 chronologies stratified according to elevation for all species (open bars) and for Douglas-fir (hatched bars). The numbers in each of the classes are shown in the upper left.

overlap and variation among them, so that a large number of chronologies from each of the species are of high quality.

Using the data from Table II, a "good" climatic chronology for pinyon would be expected to have a mean sensitivity of 0.412, but half of the time the statistic will be higher than 0.477 or lower than 0.347. It would be rare ($p < 0.05$) for a "good" climatic chronology for pinyon to have a mean sensitivity higher than 0.605 or lower than 0.219. Similarly, statements on the expected values for other statistics and species may be deduced from the other data in the table.

The data stratified by latitude (Fig. 3) indicate how the statistics vary from north to south over the grid. The largest mean sensitivities and standard deviations are to be expected between latitudes 30°N and 40°N, largest serial correlations between latitudes 40°N and 50°N, and smallest serial correlations at latitudes greater than 50°N. However, mean sensitivities and standard deviations range most widely at low latitudes, and serial correlations range most widely at latitudes between 40°N and 50°N.

The data in Figure 4 indicate the effects of increasing elevation. Both mean sensitivities and standard deviations are generally largest at elevations ranging from 6,000 feet (1829 m) to 7,500 feet (2286 m), while serial correlations are generally largest at the highest elevations. In general, the changes in statistics associated with latitude and elevation for Douglas-fir appear similar to the other species, although the differences are more systematic (less variable from one stratification to the next) when only Douglas-fir is included rather than when all species are considered as a single set.

It is interesting to note from the data in these figures and tables for chronologies from arid sites, how infrequently values of mean sensitivity are less than 0.2 and how infrequently values of serial correlation are above 0.6; yet, such values appear to be common for chronologies from temperate or more polar sites. It would be very useful for comparative purposes to have these same statistics for all areas studied throughout the world.

As data from well-dated tree-ring chronologies become available from other areas in North America or from areas around the globe, the aforementioned characteristics should be examined in a similar manner to select materials for constructing new data sets or for expanding and improving the old grids. It would also be desirable for comparisons with other data to assess the final selection through stratification and measurement of the variability in the most important chronology statistics. These statistics can then serve as guidelines for evaluating new collections and for assessing the extent of any improvements or existence of undesirable characteristics that may be encountered when using them.

II. THE CHRONOLOGIES

The Laboratory of Tree-Ring Research is internationally known for its collections of tree-ring chronologies. These collections began at the turn of the century with the work of A. E. Douglass, founder of the Laboratory. Douglass sampled trees in the southwestern United States and developed many of the theories and techniques still used in dendrochronology today. His work was continued by Edmund Schulman who worked to expand the geographical range of collected tree-ring sites. Both of these men made substantial and enduring contributions to the science of dendrochronology and to its subfield, dendroclimatology.

Today, the refinement of field criteria for the selection of specimens and of laboratory methods (Schulman, 1956; Stokes and Smiley, 1968; Fritts, in press) continues. The Laboratory includes a staff of highly skilled dendrochronologists with many years of experience. As these researchers continue their studies, new chronologies are developed. These new chronologies include an expansion of the geographical range in North America and also collections in Europe, South America, Australia, and New Zealand. The effects of each microsite are being more closely examined, new species are being sampled for their suitability to dendrochronology, sites are being more uniformly sampled so that comparisons among sites can be made, and different attributes of growth (earlywood only, latewood only, wood density) are being examined.

The increasing number of chronologies has necessitated the coordination of collections. A copy of each final chronology and its associated site information and statistics are housed in the Data Processing section of the Laboratory. It is under the direction of L. G. Drew and D. J. Buecher. Tree-ring chronologies are stored on magnetic tape with card backup.

G. Robert Lofgren has developed software for the CDC 6400 computer to retrieve and manipulate chronologies stored on magnetic tapes. His programs accomplish one objective of the Data Processing section--to make final chronologies readily accessible for analysis in research projects. As explained earlier in the text, Donald Stevens has developed software for the DEC-10 computer (Program SIPP) to do selective searches on site information of various types. The information for approximately one hundred sites is now stored on the computer. Personnel in the Data Processing section expect to enter site information for all final chronologies within the next year.

In addition to acquisition and cataloging, final chronologies need to be published periodically so that basic data are available to other researchers. Edmund Schulman began the publication of collections in 1956 with *Dendroclimatic Changes in Semiarid America*. The Data Processing section took over this task in 1972 with the publication of six volumes of the "Tree-Ring Chronologies of Western America." Volume 1 of this series, edited by M. A. Stokes, L. G. Drew, and C. W. Stockton and entitled "Selected Tree-Ring Stations," described and published the 49-station network for western North America. The remaining volumes were published as geographical units of chronologies. The chronologies selected for publication were screened for length, mean sensitivity, and serial (auto) correlation.

This current volume includes previously unpublished chronologies from 102 stations in the expanded North American grid. They are described more fully in Section I of this text.

The chronologies themselves are the result of work done by members of the Laboratory staff. They are listed as contributors to this volume. Several

different research projects were involved and are cited earlier in the text. Those members most instrumental in the field collections include C. W. Stockton, J. S. Dean, M. A. Stokes, C. W. Ferguson, M. A. Wiseman, D. O. Bowden, and T. P. Harlan. Each chronology represents many hours of work by dendrochronologists and laboratory technicians.

Site information for the chronologies included in the 102-station grid is tabulated in Table I. This information is repeated at the beginning of each chronology published herein. The information included is as follows:

Line 1: site name, state, country, and collectors;

Line 2: identification number, species (see Key to Species, page 11), grid number, latitude, longitude, elevation in meters, total length, beginning date, ending date, number of cores included, serial (auto) correlation, standard deviation, and mean sensitivity;

Line 3: azimuth of exposure in degrees, slope angle in degrees, and publication information.

POWERHOUSE ALB CAN C.W. FERGUSON & M.L. PARKER
057540 PSME* 4 5112N 11531W 1432M 556Y 1410:1965 20C SR: .43 SD: .33 MS: .30
AZ:999 SL:99 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

TREE RING INDICES

DATE	0	1	2	3	4	5	6	7	8	9
1410	151	174	96	122	113	79	97	105	117	125
1420	86	114	90	106	89	86	98	64	40	76
1430	110	111	74	79	87	73	101	82	105	88
1440	62	87	83	155	109	91	109	102	67	82
1450	102	94	144	91	103	95	113	123	108	112
1460	116	123	134	120	136	116	108	69	144	161
1470	167	129	55	80	117	90	76	94	53	69
1480	94	91	81	57	47	30	88	99	62	48
1490	105	104	69	124	108	99	113	112	61	81
1500	102	137	97	85	81	92	111	68	120	125
1510	71	133	120	81	126	59	63	131	147	183
1520	116	138	89	142	154	141	84	135	88	147
1530	129	125	122	95	46	111	152	173	127	165
1540	100	166	179	90	147	124	129	136	137	132
1550	132	163	100	122	58	117	33	99	73	85
1560	66	73	81	66	98	120	95	51	80	73
1570	97	80	98	50	131	124	67	87	58	80
1580	55	82	77	70	90	98	114	94	112	117
1590	161	155	131	95	69	93	97	118	112	96
1600	70	92	90	95	60	79	75	77	119	116
1610	92	118	88	116	116	99	105	96	83	74
1620	58	86	73	63	116	100	81	47	110	40
1630	74	95	113	109	86	54	83	50	77	80
1640	91	94	80	112	96	87	50	72	86	96
1650	92	60	66	57	68	44	78	39	71	79
1660	77	48	111	76	54	106	115	112	140	153
1670	107	118	176	142	100	155	114	71	103	107
1680	119	120	81	70	48	88	93	77	75	104
1690	109	105	28	86	88	62	51	73	88	50
1700	84	38	67	46	67	56	8	89	65	95
1710	86	108	93	113	116	75	82	44	61	71
1720	63	58	129	131	152	81	115	156	169	104
1730	60	95	108	124	67	118	75	79	84	75
1740	94	68	103	96	76	113	77	56	66	79
1750	127	50	104	96	115	122	104	56	78	25
1760	92	96	116	102	23	79	31	124	75	143
1770	151	114	63	93	114	113	78	74	112	110
1780	106	157	122	86	78	64	143	151	101	168
1790	71	44	120	34	62	83	52	121	96	99
1800	39	149	100	107	106	102	121	118		38
1810	109	82	67	81	46	26	95	47	68	94
1820	90	91	74	80	66	91	111	104	109	140
1830	118	27	97	90	78	87	93	74	75	99
1840	123	88	61	31	51	79	75	45	84	56
1850	77	56	52	70	60	108	119	91	87	99
1860	113	98	97	46	92	66	119	81	87	63
1870	76	92	149	141	154	167	153	159	156	174
1880	177	190	82	117	99	170	211	125	115	44
1890	133	97	75	104	89	93	48	113	170	165
1900	160	161	165	117	177	127	107	116	148	94
1910	98	120	106	138	125	108	191	130	94	68
1920	109	74	65	112	118	118	106	141	112	103
1930	99	67	141	104	91	149	56	58	114	54
1940	68	75	111	117	103	128	129	158	137	98
1950	137	116	131	149	119	109	97	86	97	153
1960	110	87	91	135	126	141				

NUMBER OF SAMPLES

DATE	0	1	2	3	4	5	6	7	8	9
1410	1	1	1	1	1	1	1	1	1	1
1420	1	1	1	1	1	1	1	1	1	1
1430	2	2	2	2	2	2	2	2	2	2
1440	2	2	2	2	2	2	2	2	2	2
1450	2	2	2	2	2	2	2	2	2	2
1460	2	2	2	2	2	2	2	2	2	2
1470	3	3	3	3	3	3	3	3	3	3
1480	5	5	5	5	5	5	5	5	5	5
1490	5	5	5	5	5	5	5	5	5	5
1500	5	5	5	5	5	5	5	5	5	5
1510	5	5	5	5	5	5	5	5	5	5
1520	5	5	5	5	5	5	5	5	5	5
1530	5	5	5	5	5	5	5	5	5	5
1540	5	5	5	5	5	5	5	5	5	5
1550	5	5	5	5	5	5	5	5	5	5
1560	8	8	8	8	8	8	8	8	8	8
1570	8	8	8	8	8	8	8	8	8	8
1580	8	8	8	8	8	8	8	8	8	8
1590	8	8	8	8	8	8	8	8	8	8
1600	8	8	8	8	8	8	8	8	8	8
1610	8	8	8	8	8	8	8	8	8	8
1620	8	8	8	8	8	8	8	8	8	8
1630	8	8	8	8	8	8	8	8	8	8
1640	8	8	8	8	8	8	8	8	8	8
1650	8	8	8	8	8	8	8	8	8	8
1660	8	8	8	8	8	8	8	8	8	8
1670	8	8	8	8	8	8	8	8	8	8
1680	8	8	8	8	8	8	8	8	8	8
1690	8	8	8	8	8	8	8	8	8	8
1700	8	8	8	8	8	8	8	8	8	8
1710	8	8	8	8	8	8	8	8	8	8
1720	10	10	10	10	10	10	10	10	10	10
1730	11	11	11	11	11	11	11	11	11	11
1740	12	12	12	12	12	12	12	12	12	12
1750	12	12	12	12	12	12	12	12	12	12
1760	12	12	12	12	12	12	12	12	12	12
1770	12	12	12	12	12	12	12	12	12	12
1780	13	13	13	13	13	13	13	13	13	13
1790	13	13	13	13	13	13	13	13	13	13
1800	15	15	15	15	15	15	15	15	15	15
1810	15	15	15	15	15	15	15	15	15	15
1820	15	15	15	15	15	15	15	15	15	15
1830	15	15	15	15	15	15	15	15	15	15
1840	15	15	15	15	15	15	15	15	15	15
1850	17	17	17	17	17	17	17	17	17	17
1860	20	20	20	20	20	20	20	20	20	20
1870	20	20	20	20	20	20	20	20	20	20
1880	20	20	20	20	20	20	20	20	20	20
1890	20	20	20	20	20	20	20	20	20	20
1900	20	20	20	20	20	20	20	20	20	20
1910	20	20	20	20	20	20	20	20	20	20
1920	20	20	20	20	20	20	20	20	20	20
1930	20	20	20	20	20	20	20	20	20	20
1940	20	20	20	20	20	20	20	20	20	20
1950	20	20	20	20	20	20	20	20	20	20
1960	20	20	20	20	20	20				

SERIAL CORRELATION = .427 STANDARD DEVIATION = .326 MEAN SENSITIVITY = .305 N = 556

*See Key to Species, page 11

PRECEDING PAGE BLANK-NOT FILMED

OEAD INDIAN HILL   WY   USA   C. FERGUSON & D. DESPAIN
315547 PSME 11 4445N 10920W 2133M   672Y 1300:1971   19C SR: .58 SO: .28 MS: .37
AZ:270 SL:25 NOTES: PUB. IN "TREE-RING CHRON. FOR DENOROCLIMATIC ANALYSIS" 1976

	TREE RING INDICES										NUMBER OF SAMPLES									
OATE	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
1300	155	79	[illegible]	123	62	104	68	53	146	121	1	1	1	1	1	1	1	1	1	1
1310	153	112	[illegible]	165	155	127	129	49	66	79	1	2	2	2	2	2	2	2	2	2
1320	47	71	108	86	32	121	133	50	93	94	2	2	2	2	2	2	2	2	2	2
1330	105	91	145	78	65	90	50	62	122	120	2	2	2	2	2	2	2	2	2	2
1340	72	153	144	130	55	77	88	146	130	91	2	2	2	2	2	2	2	2	2	2
1350	120	141	68	92	115	63	112	113	113	127	2	2	2	2	2	2	2	2	2	2
1360	81	54	125	99	98	87	92	90	108	109	2	2	2	2	2	2	2	2	2	2
1370	137	114	71	96	98	85	103	91	87	45	2	2	2	2	2	2	2	2	2	2
1380	40	30	46	105	139	122	150	120	63	85	2	2	2	2	2	2	2	2	2	2
1390	75	88	106	57	97	105	108	126	67	70	2	2	2	2	2	2	2	2	2	2
1400	96	62	122	168	164	200	201	174	129	141	2	2	2	2	2	2	2	2	2	2
1410	88	131	156	109	99	79	55	37	170	216	2	2	2	2	2	2	2	2	2	2
1420	275	248	136	78	128	118	146	93	121	87	2	1	1	1	1	1	1	1	1	1
1430	82	87	84	79	102	82	29	19	31	33	1	1	1	1	1	1	1	1	1	1
1440	27	34	87	66	44	85	114	103	58	58	1	1	1	1	1	1	1	1	1	1
1450	44	48	76	94	115	73	87	116	68	68	1	1	1	1	1	1	1	1	1	1
1460	40	51	72	43	79	82	73	48	49	51	1	1	1	1	1	1	1	1	1	1
1470	52	33	31	29	29	22	27	29	44	42	1	1	1	1	1	1	1	1	1	1
1480	49	27	57	58	53	68	53	84	61	77	1	1	1	1	1	1	1	1	1	1
1490	91	88	66	71	82	53	61	72	59	56	1	1	1	1	1	1	1	1	1	1
1500	48	41	30	27	60	19	41	72	97	45	1	1	1	1	1	1	1	1	1	1
1510	73	42	34	8	23	17	40	37	38	55	1	1	1	1	1	1	1	1	1	1
1520	49	70	79	120	103	118	124	131	51	126	1	1	1	1	1	1	1	1	1	1
1530	123	96	75	73	42	67	58	95	86	114	1	1	1	1	1	1	1	1	1	1
1540	133	136	90	84	119	103	125	119	192	152	1	1	1	1	1	1	1	1	1	1
1550	177	174	130	134	185	147	148	177	193	194	1	1	1	1	1	1	1	1	1	1
1560	159	156	179	108	186	124	177	125	138	82	1	1	1	1	1	1	1	1	1	1
1570	119	106	123	146	153	173	124	157	134	171	1	1	1	1	1	1	1	1	1	1
1580	38	91	107	107	96	71	63	55	96	83	2	2	2	2	2	2	2	2	2	2
1590	117	88	105	67	93	102	137	94	49	88	2	2	2	2	2	2	2	2	2	2
1600	93	99	125	138	108	124	99	100	127	132	2	2	2	2	2	2	2	2	2	2
1610	84	154	96	106	123	145	129	141	102	140	3	3	3	3	4	4	4	4	4	4
1620	130	128	110	119	157	130	120	97	116	120	4	5	6	6	6	6	6	6	6	7
1630	69	60	54	123	112	133	139	85	121	145	6	9	9	9	9	9	9	9	9	9
1640	159	136	113	134	119	90	115	91	53	98	10	11	11	11	11	11	11	11	11	11
1650	95	122	91	76	106	125	98	82	78	58	11	12	12	12	12	12	12	12	12	12
1660	73	138	113	92	78	42	92	73	74	64	12	12	12	12	12	12	12	12	12	12
1670	83	70	87	122	121	144	182	69	97	96	12	12	12	12	12	12	12	12	12	12
1680	122	63	72	74	96	102	99	135	104	105	12	12	12	12	13	13	13	13	13	13
1690	97	85	92	98	105	128	85	56	66	79	13	13	13	13	13	13	13	13	13	13
1700	145	138	108	6	88	82	93	125	73	135	13	13	13	13	13	13	13	13	13	13
1710	131	113	109	130	147	130	122	37	33	125	14	14	14	14	14	14	14	14	14	14
1720	95	104	82	106	134	141	159	147	137	143	14	14	14	15	15	15	15	15	15	15
1730	122	113	90	114	51	95	90	80	39	63	15	15	15	15	15	15	15	15	15	15
1740	44	63	88	63	24	74	115	144	136	98	15	15	15	15	15	15	15	15	15	15
1750	137	146	143	108	81	83	67	86	66	67	15	15	15	15	15	15	15	16	16	16
1760	69	95	106	114	109	116	131	125	147	99	16	16	16	16	16	16	16	16	16	16
1770	83	120	127	122	94	133	110	121	114	103	16	16	16	17	17	17	17	17	17	18
1780	98	58	79	93	76	84	84	111	109	75	18	18	18	18	18	18	18	18	18	18
1790	97	100	114	77	111	74	151	152	60	129	18	18	18	18	18	18	18	18	18	18
1800	53	81	105	100	122	82	44	45	76	75	18	18	18	18	18	18	18	18	18	18
1810	118	133	85	108	135	106	84	131	109	111	18	18	18	18	18	18	18	18	18	18
1820	104	132	69	78	105	119	97	114	144	132	18	18	18	18	18	18	18	18	18	18
1830	147	76	123	116	106	102	94	126	102	186	18	18	18	18	17	17	17	17	17	17
1840	65	128	71	104	124	99	113	96	65	174	17	17	17	17	17	17	17	17	17	17
1850	67	119	107	138	171	51	109	50	88	93	17	17	17	17	17	17	17	17	17	17
1860	69	66	86	36	32	30	118	71	87	99	17	17	17	17	17	17	17	17	17	17
1870	91	87	84	116	99	96	56	102	109	110	17	17	17	17	17	17	17	17	17	17
1880	117	89	73	67	80	83	57	73	79	55	17	17	17	17	17	17	17	17	17	17
1890	56	61	109	49	97	91	58	78	116	118	17	17	17	17	17	17	17	17	17	17
1900	115	82	38	87	61	112	119	143	126	154	17	17	17	17	17	17	17	17	17	17
1910	113	103	120	159	123	107	165	131	123	82	17	17	17	17	17	17	17	17	17	17
1920	132	140	101	108	151	143	106	109	101	163	17	17	17	17	17	17	17	17	17	17
1930	43	139	120	71	50	110	64	69	91	51	17	17	17	17	17	17	17	17	17	17
1940	92	85	93	111	109	104	95	72	82	85	17	17	17	17	17	17	17	17	17	17
1950	130	164	134	80	69	66	79	94	106	78	17	17	17	17	17	17	17	17	17	17
1960	82	74	87	143	131	129	113	115	104	99	17	17	17	17	17	17	17	17	17	17
1970	130	87									17	13								

SERIAL CORRELATION =   .577   STANOARO OEVIATION =   .280   MEAN SENSITIVITY =   .370   N = 672

GROS VENTRE & UHL HILL WY USA C.W. FERGUSON
552590 PIFL 12 4342N 11031W 2179M 572Y 1400:1971 24C SR: .58 SD: .38 MS: .24
AZ:180 SL:45 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

	TREE RING INDICES										NUMBER OF SAMPLES									
DATE	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
1400	161	192	213	197	275	202	275	124	275	243	1	1	1	1	1	1	1	1	1	1
1410	72	254	197	171	238	207	155	98	207	170	1	1	1	1	1	1	1	1	1	1
1420	253	201	206	135	248	201	129	232	129	170	1	1	1	1	1	1	1	1	1	1
1430	191	216	155	129	180	206	98	159	170	87	1	1	1	1	1	1	1	1	1	1
1440	170	154	103	195	103	190	82	118	118	98	1	1	1	1	1	1	1	1	1	1
1450	118	174	92	118	92	164	159	205	154	174	1	1	1	1	1	1	1	1	1	1
1460	118	138	156	168	113	116	115	132	104	97	1	1	2	2	2	2	2	2	2	2
1470	99	101	106	132	82	57	70	56	106	101	3	3	3	3	3	3	3	3	3	3
1480	110	92	92	62	108	86	123	96	78	79	3	3	3	3	3	3	3	3	3	3
1490	99	93	85	87	80	77	113	104	110	78	3	3	3	3	3	3	3	3	3	3
1500	104	54	92	97	96	91	126	115	131	130	3	3	3	3	3	3	3	3	3	3
1510	105	82	72	64	85	90	119	89	54	90	3	4	4	4	4	4	4	5	5	5
1520	51	99	80	113	133	157	123	91	103	65	5	5	5	6	6	7	7	7	7	7
1530	80	97	67	61	37	65	76	74	103	104	7	7	7	7	7	7	7	7	7	7
1540	101	92	112	62	100	60	96	65	54	113	7	7	7	7	7	7	7	7	7	7
1550	120	123	135	132	109	139	153	155	183	168	7	7	8	8	8	8	8	8	9	9
1560	184	128	109	95	143	128	150	140	138	128	9	9	9	9	9	9	9	9	9	9
1570	93	132	107	107	133	100	93	133	79	116	9	9	9	9	9	9	10	10	10	10
1580	73	104	90	120	72	59	85	91	63	87	10	10	10	10	10	10	10	10	10	10
1590	84	92	[illegible]	54	103	54	118	95	77	118	10	10	10	10	10	10	11	11	11	11
1600	76	109	103	92	132	96	130	84	119	134	11	11	11	11	11	11	11	11	11	11
1610	114	167	111	119	98	117	129	173	123	156	11	11	11	11	11	11	11	11	11	11
1620	98	161	161	152	170	164	112	101	119	92	11	12	12	12	12	12	12	12	12	12
1630	104	56	38	122	103	91	100	87	87	53	12	12	12	12	12	12	12	13	13	13
1640	98	92	87	92	69	72	50	78	78	53	13	13	13	13	13	13	13	13	13	13
1650	93	89	78	83	101	89	76	58	59	48	13	13	13	13	13	13	13	13	13	13
1660	77	83	78	78	91	90	95	94	92	92	13	13	13	13	13	13	13	13	13	13
1670	84	54	88	80	105	88	116	108	75	59	13	13	13	13	13	13	13	13	13	13
1680	106	77	100	104	123	98	76	122	116	109	13	13	14	14	14	14	14	14	14	14
1690	92	130	137	104	145	55	103	95	96	110	14	14	14	14	15	15	15	15	15	15
1700	139	129	121	89	76	105	117	91	74	91	16	17	17	17	17	17	17	17	17	17
1710	58	79	75	91	106	105	104	56	68	92	17	17	17	17	17	17	17	17	17	17
1720	108	59	73	88	98	106	136	134	122	72	18	18	18	18	18	18	18	18	18	18
1730	80	101	67	114	105	62	107	89	110	93	18	18	18	18	18	18	18	18	18	18
1740	93	93	79	83	62	80	102	111	96	92	18	18	18	18	18	18	18	18	18	18
1750	123	112	113	88	64	89	60	77	68	70	18	18	18	18	18	18	18	18	18	18
1760	81	97	97	102	118	72	140	145	116	110	18	18	18	18	18	18	18	18	18	18
1770	100	108	100	94	101	114	122	83	99	109	18	18	18	18	18	18	18	18	18	18
1780	104	114	74	75	89	88	101	111	88	134	18	18	18	18	18	18	18	18	18	19
1790	110	116	127	118	106	62	101	91	87	105	19	19	19	20	20	20	20	21	21	21
1800	73	94	119	144	72	111	50	95	64	97	21	22	22	22	22	22	22	22	22	23
1810	110	117	110	106	51	108	57	102	73	88	23	23	23	23	23	23	24	24	24	24
1820	96	115	62	58	59	80	79	92	109	92	24	24	24	24	24	24	24	24	24	24
1830	82	52	78	79	56	80	73	108	99	127	24	24	24	24	24	24	24	24	24	24
1840	104	91	57	88	62	86	56	97	54	117	24	24	24	24	24	24	24	24	24	24
1850	120	100	88	141	153	119	113	95	117	111	24	24	24	24	24	24	24	24	24	24
1860	106	98	117	52	74	40	129	121	128	89	24	24	24	24	24	24	24	24	24	24
1870	124	96	90	115	64	105	108	117	110	112	24	24	24	24	24	24	24	24	24	24
1880	98	90	76	80	90	103	71	72	70	43	24	24	24	24	24	24	24	24	24	24
1890	60	45	68	55	63	80	72	87	117	92	24	24	24	24	24	24	24	24	24	24
1900	93	69	57	67	78	90	94	131	143	139	24	24	24	24	24	24	24	24	24	24
1910	151	139	99	145	166	143	152	131	157	87	24	24	24	24	24	24	24	24	24	24
1920	115	107	126	142	64	150	107	159	153	133	24	24	24	24	24	24	24	24	24	24
1930	150	131	111	75	57	100	55	95	112	95	24	24	24	24	24	24	24	24	24	24
1940	105	126	157	107	147	153	119	126	98	83	24	24	24	24	24	24	24	24	24	24
1950	110	112	107	94	104	74	100	[illegible]	87	98	24	24	24	24	24	24	24	24	24	24
1960	93	84	128	165	142	154	114	[illegible]	129	111	24	24	24	24	24	24	24	24	24	24
1970	132	136									24	24								

SERIAL CORRELATION = .580 STANDARD DEVIATION = .379 MEAN SENSITIVITY = .242 N = 572

WIND RIVER 'D' WY USA HARSHA, STOCKTON & JACOBY
283590 PIFL 13 4305N 11004W 2499M 481Y 1492:1972 20C SR: .51 SD: .27 MS: .20
AZ:245 SL:30 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

	TREE RING INDICES										NUMBER OF SAMPLES									
DATE	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
1492			90	55	54	71	122	87	107	163			1	1	1	1	1	1	1	2
1500	105	101	54	70	160	98	93	83	161	146	2	2	2	2	2	2	2	3	3	3
1510	117	97	94	50	107	118	137	129	127	86	3	3	3	3	3	3	3	3	3	3
1520	91	101	70	107	136	161	103	115	154	104	3	3	3	3	3	3	3	3	3	3
1530	65	106	83	82	79	126	138	120	101	142	3	4	4	4	4	4	4	4	4	4
1540	103	60	93	68	115	65	106	64	97	89	4	4	4	4	4	4	4	4	4	4
1550	122	119	138	141	134	118	93	129	127	125	4	4	4	4	4	4	4	4	4	4
1560	176	152	154	92	173	144	93	141	124	116	4	4	5	5	5	5	5	5	5	5
1570	124	90	90	77	[illegible]	93	70	95	64	68	5	5	5	5	5	5	5	5	5	5
1580	95	66	82	121	65	27	47	84	110	99	5	5	5	5	5	5	5	5	5	5
1590	101	116	79	74	78	43	90	105	61	76	5	5	5	5	5	5	5	5	5	5
1600	75	109	79	113	136	87	92	81	111	111	5	5	5	5	5	5	5	5	5	5
1610	106	134	69	80	85	116	150	173	141	90	5	5	5	5	5	5	5	5	5	5
1620	157	190	226	191	198	204	70	145	159	130	5	5	5	5	6	6	6	6	6	6
1630	88	59	11	104	146	136	142	87	135	76	6	6	6	6	6	6	6	6	6	6
1640	134	154	138	158	163	84	77	105	92	65	7	7	7	7	7	7	7	7	7	7
1650	113	137	102	95	125	142	134	94	84	56	7	7	7	7	7	7	7	7	7	7
1660	113	107	96	90	123	131	104	71	111	72	7	7	7	7	8	8	8	8	8	8
1670	89	67	79	109	102	75	94	59	58	66	8	8	8	8	8	8	8	8	8	9
1680	102	72	80	100	96	117	90	106	101	123	9	9	9	9	9	9	9	9	9	9
1690	98	107	125	125	132	83	91	113	78	96	9	9	9	9	9	9	9	9	9	9
1700	110	105	126	74	64	89	89	95	66	66	9	9	9	9	9	9	9	9	10	11
1710	76	71	56	57	84	86	84	62	68	94	11	11	11	11	11	11	11	11	11	11
1720	111	50	71	97	83	79	107	117	103	72	12	12	12	12	12	12	12	12	12	12
1730	99	105	94	111	124	81	107	82	88	86	13	13	13	13	13	13	13	13	13	13
1740	93	93	79	89	71	99	114	108	99	108	14	14	14	14	14	14	14	14	14	14
1750	118	121	104	102	94	124	90	110	90	84	14	14	15	15	15	15	15	15	15	15
1760	113	117	87	114	127	106	120	130	125	116	15	15	15	15	15	15	15	15	15	15
1770	96	106	108	92	87	90	104	114	95	86	15	15	15	15	15	16	17	17	17	17
1780	100	78	72	83	68	84	95	91	86	91	17	17	17	17	17	17	17	17	17	17
1790	92	116	121	107	100	65	101	85	105	100	17	17	17	17	17	17	17	17	17	17
1800	112	109	102	131	84	101	75	75	80	75	17	17	17	17	17	17	17	17	17	17
1810	90	116	102	110	62	105	108	96	74	92	18	18	18	19	19	19	19	19	19	19
1820	115	113	78	99	80	79	80	86	90	87	20	20	20	20	20	20	20	20	20	20
1830	86	81	72	98	102	90	95	108	97	109	20	20	20	20	20	20	20	20	20	20
1840	106	117	101	116	97	99	57	82	80	85	20	20	20	20	20	20	20	20	20	20
1850	84	89	69	92	117	91	64	86	87	79	20	20	20	20	20	20	20	20	20	20
1860	83	90	95	84	78	79	104	101	121	126	20	20	20	20	20	20	20	20	20	20
1870	104	96	74	103	113	100	92	59	91	116	20	20	20	20	20	20	20	20	20	20
1880	81	107	91	78	95	105	90	93	112	84	20	20	20	20	20	20	20	20	20	20
1890	97	113	99	72	66	96	85	80	95	92	20	20	20	20	20	20	20	20	20	20
1900	102	111	78	81	105	112	[illegible]	133	141	123	20	20	20	20	20	20	20	20	20	20
1910	137	121	133	152	189	162	15.	142	143	117	20	20	20	20	20	20	20	20	20	20
1920	128	104	120	125	91	113	03	111	121	103	20	20	20	20	20	20	20	20	20	20
1930	101	121	114	94	78	99	91	109	119	112	20	20	20	20	20	20	20	20	20	20
1940	117	123	103	115	123	96	07	118	106	109	20	20	20	20	20	20	20	20	20	20
1950	96	118	114	96	104	87	81	104	90	73	20	20	20	20	20	20	20	20	20	20
1960	78	67	87	110	113	111	120	125	109	120	20	20	20	20	20	20	20	20	20	20
1970	106	77	90								20	20	16							

SERIAL CORRELATION = .508 STANDARD DEVIATION = .266 MEAN SENSITIVITY = .205 N = 481

ELBOW CAMPGROUND WY USA C.W. FERGUSON & M.L. PARKER
051549 PSME 14 4313N 11047W 1981M 476Y 1490:1965 32C SR: .58 SD: .36 MS: .28
A7:999 SL:99 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

TREE RING INDICES

DATE	0	1	2	3	4	5	6	7	8	9
1490	62	72	107	140	110	75	80	69	162	145
1500	137	78	116	85	86	113	147	82	138	93
1510	134	140	81	41	50	58	74	32	65	100
1520	42	127	79	171	155	133	216	246	173	131
1530	114	45	37	83	27	52	59	92	82	153
1540	231	121	77	106	105	46	124	94	103	88
1550	69	112	136	140	151	153	94	102	88	155
1560	220	178	124	106	57	21	68	60	69	66
1570	64	64	102	54	71	104	72	57	25	79
1580	55	63	60	58	46	99	33	15	62	92
1590	79	114	66	70	76	67	76	30	137	99
1600	85	133	67	159	136	126	180	149	139	124
1610	114	151	164	175	131	75	90	55	55	91
1620	72	30	18	21	24	44	21	20	47	19
1630	35	18	4	80	72	72	45	30	46	41
1640	93	119	101	79	69	91	43	98	66	53
1650	118	130	54	103	126	106	64	25	86	116
1660	143	140	95	119	88	140	213	129	128	98
1670	106	77	127	87	97	72	129	128	68	97
1680	144	110	134	166	165	123	114	173	150	131
1690	115	135	158	105	132	67	75	95	101	89
1700	126	117	122	74	70	131	121	69	83	95
1710	55	78	70	100	99	100	102	58	57	83
1720	116	68	66	99	94	110	156	167	146	76
1730	101	90	97	143	132	75	106	112	97	69
1740	73	105	106	91	55	108	127	126	124	121
1750	127	111	93	105	106	101	69	91	92	83
1760	82	114	105	98	99	77	113	177	107	110
1770	95	114	90	109	81	147	156	150	128	120
1780	125	117	80	75	98	104	111	115	117	169
1790	122	100	138	109	106	64	109	114	90	114
1800	91	85	98	105	73	107	93	82	77	79
1810	130	127	159	130	79	82	85	80	95	102
1820	123	122	93	92	85	94	101	95	126	122
1830	106	89	117	123	87	108	111	123	133	90
1840	91	103	64	63	76	68	44	45	53	79
1850	86	73	54	96	112	112	59	83	86	64
1860	79	93	107	73	80	68	139	141	135	116
1870	132	70	92	130	81	107	113	94	98	92
1880	87	96	85	92	94	109	92	80	110	86
1890	69	62	99	61	86	86	67	81	142	111
1900	112	81	87	102	111	116	125	193	189	163
1910	187	155	128	143	149	85	119	78	137	92
1920	74	111	102	91	67	115	110	132	127	85
1930	91	120	65	75	51	72	51	60	101	82
1940	81	68	121	73	86	83	96	101	126	85
1950	87	106	56	73	68	40	90	72	86	104
1960	98	92	125	185	136	134				

NUMBER OF SAMPLES

DATE	0	1	2	3	4	5	6	7	8	9
1490	1	1	1	1	1	1	1	1	1	1
1500	2	2	2	2	2	2	2	2	2	2
1510	2	2	2	2	2	2	2	2	2	2
1520	2	2	2	2	2	2	2	2	2	2
1530	2	2	2	2	2	2	2	2	2	2
1540	2	2	2	2	2	2	2	2	2	2
1550	2	2	2	2	2	2	2	2	2	2
1560	2	2	2	2	2	2	2	2	2	2
1570	2	2	2	2	2	2	2	2	2	2
1580	2	2	2	2	2	2	2	2	2	2
1590	2	2	2	2	2	2	2	2	2	2
1600	2	2	2	2	2	2	2	2	2	2
1610	2	2	2	2	2	2	2	2	2	2
1620	2	2	2	2	2	2	2	2	2	2
1630	2	2	2	3	3	3	3	3	3	3
1640	3	3	3	3	3	3	3	3	3	3
1650	3	3	3	3	3	3	3	3	3	3
1660	3	3	3	3	3	3	3	3	3	3
1670	3	3	3	3	3	3	3	4	4	4
1680	6	7	7	7	7	7	8	9	9	9
1690	11	11	11	11	11	11	11	11	11	11
1700	11	11	11	11	11	11	11	11	11	11
1710	11	11	11	11	11	11	11	11	11	11
1720	14	14	14	14	14	14	14	14	14	14
1730	14	14	14	14	14	14	14	14	14	14
1740	15	15	15	16	16	16	17	17	17	17
1750	17	17	17	17	17	17	17	17	17	17
1760	19	20	20	20	20	20	20	20	22	22
1770	23	23	23	23	23	23	23	23	23	23
1780	24	24	24	24	24	24	25	25	25	25
1790	25	25	25	25	26	26	26	27	27	27
1800	28	28	28	28	28	28	30	30	30	30
1810	30	30	30	30	30	30	30	30	30	30
1820	30	30	30	30	30	30	30	30	30	30
1830	30	30	30	30	30	30	30	30	30	30
1840	30	30	30	30	30	31	31	31	31	31
1850	32	32	32	32	32	32	32	32	32	32
1860	32	32	32	32	32	32	32	32	32	32
1870	32	32	32	32	32	32	32	32	32	32
1880	32	32	32	32	32	32	32	32	32	32
1890	32	32	32	32	32	32	32	32	32	32
1900	32	32	32	32	32	32	32	32	32	32
1910	32	32	32	32	32	32	32	32	32	32
1920	32	32	32	32	32	32	32	32	32	32
1930	32	32	32	32	32	32	32	32	32	32
1940	32	32	32	32	32	32	32	32	32	32
1950	32	32	32	32	32	32	32	32	32	32
1960	32	32	32	32	32	32				

SERIAL CORRELATION = .582 STANDARD DEVIATION = .363 MEAN SENSITIVITY = .285 N = 476

BOBCAT CANYON CO USA DEAN, ROBINSON & BOWDEN
061099 PSME 20 3710N 10831W 2042M 582Y 1390:1971 18C SR: .27 SD: .42 MS: .45
AZ: 45 SL:45 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

	TREE RING INDICES										NUMBER OF SAMPLES									
DATE	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
1390	66	104	132	129	133	133	89	79	77	65	1	1	1	1	1	1	1	1	1	1
1400	58	47	64	50	133	95	124	95	79	141	1	1	1	1	1	1	1	1	1	1
1410	55	39	125	14	119	59	99	130	84	72	1	1	1	1	1	1	1	1	1	1
1420	105	63	94	62	109	107	131	116	124	127	2	2	2	2	2	2	2	2	2	2
1430	82	110	136	110	84	83	142	92	45	77	2	2	2	2	2	2	2	2	2	2
1440	93	182	79	129	125	74	77	88	105	82	2	2	2	2	2	2	2	2	2	2
1450	60	163	100	123	118	29	76	24	151	95	2	2	2	2	2	2	2	2	2	2
1460	[illegible]	60	111	123	41	77	140	193	128	160	2	2	2	2	2	2	2	2	2	2
1470	130	44	85	54	102	79	114	123	140	82	2	2	2	2	2	2	2	2	2	2
1480	73	91	110	112	186	174	197	97	139	185	2	2	2	2	2	2	2	2	2	2
1490	188	290	136	154	148	21	86	91	170	103	2	2	2	2	2	2	2	2	2	2
1500	13	83	109	109	106	69	29	67	77	119	2	2	2	2	2	2	2	2	2	2
1510	61	116	163	158	198	135	37	101	64	133	2	2	2	2	2	2	2	2	2	2
1520	153	102	47	84	90	96	165	121	85	115	2	2	2	2	2	2	2	2	2	2
1530	142	108	22	78	102	79	153	132	93	108	2	2	2	2	2	2	3	3	3	3
1540	133	102	22	110	76	95	82	67	110	84	3	3	3	3	3	3	3	3	3	3
1550	130	84	87	112	61	82	142	131	111	95	3	3	3	3	3	3	3	3	3	3
1560	116	71	68	124	137	140	85	81	150	96	3	3	3	3	3	3	3	3	3	3
1570	169	141	137	83	70	81	94	94	58	18	3	3	3	3	3	3	3	3	3	3
1580	28	64	53	40	17	10	77	31	86	44	3	3	3	3	3	3	3	3	3	3
1590	17	50	55	50	92	89	86	76	45	84	3	3	3	3	3	3	3	4	4	4
1600	41	91	74	51	78	114	91	59	115	111	6	6	6	6	6	6	6	6	6	6
1610	138	102	80	120	102	140	155	152	163	98	6	6	6	6	6	6	6	6	6	8
1620	162	174	113	60	65	62	51	101	103	117	8	8	8	8	8	8	8	8	8	8
1630	108	101	46	115	112	182	78	76	95	88	9	9	9	9	9	9	9	9	9	9
1640	120	123	128	110	98	94	138	121	64	122	9	9	9	11	11	11	11	11	12	12
1650	133	145	78	142	38	172	166	92	70	93	13	13	13	13	13	13	13	13	13	13
1660	122	68	81	71	39	128	54	36	55	61	13	13	13	13	13	13	13	13	13	13
1670	65	93	81	119	138	133	63	98	155	112	13	13	13	13	13	13	13	13	13	13
1680	146	131	163	162	40	12	81	96	95	121	13	13	13	13	13	13	13	13	13	13
1690	146	109	129	110	87	100	46	92	104	111	13	13	13	13	13	14	14	14	14	14
1700	91	149	59	95	63	134	171	50	103	96	14	14	14	14	14	14	14	14	14	14
1710	126	103	107	70	56	91	54	74	107	125	14	14	14	14	14	14	14	14	14	14
1720	192	113	93	159	60	176	131	160	90	15	14	14	14	14	14	14	14	14	14	14
1730	84	71	114	61	147	44	99	79	92	57	14	14	14	14	14	14	14	14	14	14
1740	59	81	75	121	93	148	158	210	35	174	14	14	14	14	14	14	14	14	14	14
1750	93	92	52	80	57	41	78	36	56	70	14	14	14	14	14	14	14	14	14	14
1760	43	49	76	82	91	48	125	41	112	120	14	14	14	14	14	14	14	14	14	14
1770	65	135	101	16	80	56	81	73	41	84	14	14	14	14	14	14	14	14	14	14
1780	44	61	40	108	113	95	70	110	56	65	14	14	14	14	14	14	14	14	14	14
1790	22	120	117	124	59	55	52	87	86	93	15	15	15	15	15	15	15	15	15	15
1800	88	72	128	75	121	41	51	113	56	78	16	16	16	16	16	16	16	16	16	16
1810	68	101	112	41	92	124	212	228	47	31	16	16	16	16	16	16	16	16	16	16
1820	24	155	72	36	65	102	120	80	133	103	16	16	16	16	16	16	16	16	16	16
1830	102	83	136	132	78	136	138	118	155	171	17	17	18	18	18	18	18	18	18	18
1840	212	140	79	150	162	52	134	9	140	134	18	18	18	18	18	18	18	18	18	18
1850	153	43	160	125	91	113	135	92	130	67	18	18	18	18	18	18	18	18	18	18
1860	94	10	154	101	19	106	105	154	137	147	18	18	18	18	18	18	18	18	18	18
1870	52	59	42	81	90	89	50	175	83	86	18	18	18	18	18	18	18	18	18	18
1880	76	77	51	68	110	134	124	47	155	131	18	18	18	18	18	18	18	18	18	18
1890	137	143	133	54	43	72	18	125	108	18	18	18	18	18	18	18	18	18	18	18
1900	51	109	6	110	5	116	125	159	126	167	18	18	18	18	18	18	18	18	18	18
1910	134	153	175	98	177	203	181	175	68	136	18	18	18	18	18	18	18	18	18	18
1920	178	127	161	89	127	74	168	130	136	104	18	18	18	18	18	18	18	18	18	18
1930	105	116	191	93	48	144	81	121	141	123	18	18	18	18	18	18	18	18	18	18
1940	95	188	167	114	118	103	44	100	129	157	18	18	18	18	18	18	18	18	18	18
1950	77	25	137	61	61	90	64	120	142	28	18	18	18	18	18	18	18	18	18	18
1960	124	90	77	70	85	125	124	77	95	93	18	18	18	18	18	18	18	18	18	18
1970	86	93									18	18								

SERIAL CORRELATION = .266 STANDARD DEVIATION = .420 MEAN SENSITIVITY = .446 N = 582

LA SAL MTNS, SITE A UT USA J.B. HARSHA & C.W. STOCKTON
285620 PIEO 23 3830N 10915W 2323M 484Y 1489:1972 18C SR: .41 SD: .35 MS: .34
A7: 0 SL: 0 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

DATE	TREE RING INDICES 0	1	2	3	4	5	6	7	8	9	NUMBER OF SAMPLES 0	1	2	3	4	5	6	7	8	9
1489										113										1
1490	131	189	126	101	100	41	67	85	96	48	1	1	1	1	1	1	1	1	1	1
1500	18	52	121	100	116	76	47	128	130	152	1	1	1	1	1	1	1	2	2	2
1510	85	135	87	105	103	61	61	72	55	82	2	2	2	2	2	2	2	2	2	2
1520	64	89	37	64	53	82	102	121	116	121	2	2	2	2	2	2	2	2	2	2
1530	125	106	31	100	137	117	205	182	123	166	2	2	2	2	2	2	2	2	2	2
1540	219	177	101	152	144	111	160	93	136	165	2	2	2	2	2	2	2	2	2	2
1550	160	110	84	93	90	95	79	101	65	92	2	2	2	2	4	4	4	4	5	5
1560	79	59	60	80	95	121	101	93	109	115	6	6	6	6	6	6	6	6	6	6
1570	79	93	92	90	58	91	75	103	107	84	6	6	6	6	6	6	6	6	6	6
1580	77	83	79	71	36	61	68	76	100	90	6	6	6	6	6	6	6	6	6	6
1590	54	86	78	99	127	135	124	89	51	97	6	6	6	6	6	6	6	7	7	7
1600	53	85	114	117	126	130	123	123	104	118	8	8	8	8	8	8	10	12	13	13
1610	136	105	96	146	129	131	138	150	163	139	13	13	13	13	13	14	14	14	15	15
1620	166	167	134	85	71	93	65	96	98	99	15	15	15	15	15	15	15	15	16	17
1630	81	49	46	124	107	116	94	74	68	91	17	17	17	17	17	17	17	17	17	17
1640	108	109	118	111	123	74	73	120	80	113	17	17	17	17	17	17	17	17	17	17
1650	134	118	77	73	30	121	119	122	97	78	17	17	17	17	17	17	17	17	18	18
1660	111	92	127	93	75	70	114	80	93	121	18	18	18	18	18	18	18	18	18	18
1670	55	61	116	104	111	89	72	126	127	82	18	18	18	18	18	18	18	18	18	18
1680	142	129	89	127	57	16	42	98	113	114	18	18	18	18	18	18	18	18	18	18
1690	89	97	95	138	95	125	83	114	89	98	18	18	18	18	18	18	18	18	18	18
1700	80	135	88	90	76	122	98	81	65	135	18	18	18	18	18	18	18	18	18	18
1710	101	110	102	106	60	121	108	62	144	122	18	18	18	18	18	18	18	18	18	18
1720	171	101	43	130	125	122	164	120	68	7	18	18	18	18	18	18	18	18	18	18
1730	49	108	74	37	133	33	116	106	142	87	18	18	18	18	18	18	18	18	18	18
1740	64	114	79	83	62	64	112	110	76	98	18	18	18	18	18	18	18	16	18	18
1750	62	82	63	118	94	44	44	80	101	107	18	18	18	18	18	18	18	18	18	18
1760	113	125	107	103	143	75	76	92	121	106	18	18	18	18	18	18	18	18	18	18
1770	153	148	84	97	65	76	87	98	20	98	18	18	18	18	18	18	18	18	18	18
1780	90	97	78	83	118	103	43	104	87	24	18	18	18	18	18	18	18	18	18	18
1790	96	119	100	99	102	71	117	124	46	106	18	18	18	18	18	18	18	18	18	18
1800	103	64	87	63	40	79	10	131	104	88	18	18	18	18	18	18	18	18	18	18
1810	66	144	107	65	64	121	137	103	113	89	18	18	18	18	18	18	18	18	18	18
1820	76	91	72	54	35	98	117	101	138	78	18	18	18	18	18	18	18	18	16	18
1830	102	81	103	82	63	101	114	145	130	128	18	18	18	18	18	18	18	18	18	18
1840	121	112	118	122	112	68	108	34	86	133	18	18	18	18	18	18	18	18	18	18
1850	112	26	84	77	79	71	96	107	97	83	18	18	18	18	18	18	18	18	18	18
1860	77	25	120	81	44	106	142	129	151	126	18	18	18	18	18	18	18	18	18	18
1870	93	44	81	69	66	65	80	90	81	20	18	18	18	18	18	18	18	18	18	18
1880	73	70	30	70	99	107	90	54	107	89	18	18	18	18	18	18	18	18	18	18
1890	92	99	122	96	76	107	36	115	123	50	18	18	18	18	18	18	18	18	18	18
1900	30	107	19	122	31	132	149	157	131	164	18	18	18	18	18	18	18	18	18	18
1910	153	151	147	164	169	148	155	154	111	110	18	18	18	18	18	18	18	18	18	18
1920	145	137	122	125	107	134	134	146	142	190	18	18	18	18	18	18	18	18	18	18
1930	152	108	171	172	64	96	78	118	128	129	18	18	18	18	18	18	18	18	18	18
1940	131	131	170	145	136	125	66	132	164	208	18	18	18	18	18	18	18	18	18	18
1950	206	106	199	166	95	128	46	143	133	63	18	18	18	18	18	18	18	18	18	18
1960	129	78	108	73	80	102	122	44	104	128	18	18	18	18	18	18	18	18	18	18
1970	107	62	74								18	14	14							

SERIAL CORRELATION = .414 STANDARD DEVIATION = .352 MEAN SENSITIVITY = .340 N = 484

KANE SPRINGS UT USA J.S. DEAN & D.O. BOWDEN
123000 PIED 24 3732N 10954W 1966M 527Y 1445:1971 20C SR: .36 SD: .35 MS: .35
AZ: 70 SL:10 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

	TREE RING INDICES										NUMBER OF SAMPLES									
DATE	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
1445						47	76	94	97	53						1	1	1	1	1
1450	32	156	174	136	84	67	88	92	122	163	1	1	1	1	2	2	2	2	2	2
1460	107	107	168	108	54	76	103	146	121	95	2	2	2	2	2	2	2	2	2	2
1470	92	49	54	76	137	125	138	160	131	96	2	2	2	2	2	2	2	2	2	2
1480	64	56	175	145	154	124	128	61	108	147	2	2	2	2	4	4	4	4	4	4
1490	147	173	105	116	119	57	80	108	141	85	5	5	6	6	6	7	7	7	8	8
1500	30	82	107	106	109	76	67	89	120	164	11	11	11	11	11	11	11	11	11	11
1510	101	130	113	139	134	120	92	110	98	115	11	11	11	11	11	12	12	12	12	12
1520	106	92	39	96	105	96	111	88	80	63	13	13	13	13	13	13	13	13	13	13
1530	81	102	21	51	101	99	119	116	62	70	13	13	13	13	13	13	13	13	13	13
1540	107	91	51	87	74	54	101	69	85	118	13	13	13	13	13	13	13	13	13	13
1550	129	150	109	98	66	92	108	114	100	101	14	14	14	14	14	14	14	14	14	14
1560	118	77	92	94	126	128	112	77	100	96	14	14	14	14	14	14	14	14	14	14
1570	93	80	67	75	80	85	75	114	124	113	14	14	14	14	14	14	14	14	14	14
1580	78	109	85	48	66	51	108	108	108	89	14	14	14	14	14	14	14	14	14	14
1590	33	102	74	81	153	142	146	77	81	118	14	14	14	14	14	14	14	14	14	14
1600	43	96	138	122	149	151	136	67	106	106	14	14	14	14	14	14	14	14	14	14
1610	123	106	87	36	65	119	124	137	140	112	14	14	14	14	14	14	14	14	14	14
1620	118	136	93	63	42	71	17	34	74	100	14	14	14	14	14	14	14	14	14	14
1630	91	73	53	99	106	130	99	74	84	93	15	15	15	15	15	15	15	15	15	15
1640	132	98	106	113	130	118	104	135	60	128	15	15	15	15	15	15	15	15	15	15
1650	154	110	115	127	21	93	124	109	84	108	15	15	15	15	15	15	15	15	15	15
1660	135	110	105	50	70	74	92	60	88	102	17	17	17	17	17	17	17	17	17	17
1670	25	103	133	119	156	133	85	129	146	126	17	17	17	17	17	17	17	17	17	17
1680	156	150	151	168	98	13	60	154	140	153	18	18	18	18	18	18	18	18	18	18
1690	153	142	168	154	131	143	93	93	49	93	18	18	18	18	18	18	18	18	18	18
1700	80	131	98	68	83	107	132	95	97	110	19	19	19	19	19	19	19	19	19	19
1710	106	100	90	125	104	131	114	104	144	151	19	19	19	19	19	19	19	19	19	19
1720	152	104	40	113	58	132	125	131	38	28	19	19	19	19	19	19	19	19	20	20
1730	79	86	116	48	90	26	95	87	101	94	20	20	20	20	20	20	20	20	20	20
1740	54	100	104	125	86	113	120	125	50	121	20	20	20	20	20	20	20	20	20	20
1750	99	96	54	87	90	59	75	35	87	88	20	20	20	20	20	20	20	20	20	20
1760	109	93	100	53	103	72	126	96	135	118	20	20	20	20	20	20	20	20	20	20
1770	74	123	89	19	67	92	91	55	59	91	20	20	20	20	20	20	20	20	20	20
1780	72	96	80	94	125	69	99	127	63	102	20	20	20	20	20	20	20	20	20	20
1790	48	118	100	103	82	113	109	70	112	117	20	20	20	20	20	20	20	20	20	20
1800	93	41	113	55	90	53	40	138	114	138	20	20	20	20	20	20	20	20	20	20
1810	91	130	117	11	92	92	118	114	39	64	20	20	20	20	20	20	20	20	20	20
1820	40	66	52	61	85	129	144	85	169	82	20	20	20	20	20	20	20	20	20	20
1830	115	85	124	149	119	160	126	160	137	153	20	20	20	20	20	20	20	20	20	20
1840	155	155	127	128	127	42	123	22	81	150	20	20	20	20	20	20	20	20	20	20
1850	129	57	150	118	126	138	165	128	104	68	20	20	20	20	20	20	20	20	20	20
1860	99	12	150	130	44	123	150	119	139	126	20	20	20	20	20	20	20	20	20	20
1870	109	39	47	48	89	99	93	127	105	99	20	20	20	20	20	20	20	20	20	20
1880	105	66	61	51	108	123	100	64	97	131	20	20	20	20	20	20	20	20	20	20
1890	153	139	148	105	58	114	17	141	138	43	20	20	20	20	20	20	20	20	20	20
1900	34	103	34	104	45	129	141	170	135	155	20	20	20	20	20	20	20	20	20	20
1910	150	171	153	170	174	166	198	165	109	156	20	20	20	20	20	20	20	20	20	20
1920	155	88	132	90	65	84	112	125	90	117	20	20	20	20	20	20	20	20	20	20
1930	88	76	110	100	55	109	75	91	105	96	20	20	20	20	20	20	20	20	20	20
1940	112	115	148	154	110	123	53	68	97	121	20	20	20	20	20	20	20	20	20	20
1950	102	15	112	90	94	68	44	83	104	15	20	20	20	20	20	20	20	20	20	20
1960	89	78	95	81	43	85	96	75	83	110	20	20	20	20	20	20	20	20	20	20
1970	92	72									20	20								

SERIAL CORRELATION = .365 STANDARD DEVIATION = .347 MEAN SENSITIVITY = .353 N = 527

WHITE CANYON T. UT USA J.S. DEAN & D.O. BOWDEN
141008 PSME 25 3737N 11001W 1859M 494Y 1479:1972 20C SR: .44 SD: .41 MS: .38
AZ:345 SL:55 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

	TREE RING INOICES										NUMBER OF SAMPLES									
OATE	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
1479										112										1
1480	39	71	104	95	137	107	129	43	76	109	1	1	1	1	1	1	1	1	1	2
1490	88	123	78	98	62	33	35	101	98	43	4	4	4	4	4	4	4	4	4	4
1500	22	79	51	62	107	66	62	86	69	155	4	4	4	4	4	4	4	4	4	4
1510	52	110	97	106	102	88	111	94	77	120	4	4	4	4	4	4	4	4	4	4
1520	121	123	22	65	97	87	133	106	148	150	4	4	4	4	4	4	4	4	4	4
1530	162	140	25	69	98	88	123	134	54	127	4	4	4	4	4	4	4	4	4	4
1540	141	103	21	75	55	67	101	70	100	119	4	4	4	4	4	4	4	4	4	4
1550	158	153	117	162	102	119	132	167	120	162	4	4	4	4	4	4	4	4	4	4
1560	164	115	123	129	205	190	204	109	158	142	4	4	4	4	4	4	4	4	4	4
1570	134	133	88	112	105	103	94	127	124	49	4	4	4	4	4	4	4	4	4	4
1580	61	117	143	93	45	48	138	98	184	118	4	4	4	4	4	4	4	4	4	4
1590	51	107	59	71	148	84	106	63	66	101	5	5	5	5	5	5	5	5	5	5
1600	28	95	107	118	114	153	129	69	143	153	5	5	5	5	5	5	5	5	5	5
1610	152	137	151	146	136	136	187	237	212	259	5	5	5	5	5	5	5	5	6	7
1620	266	246	173	102	41	71	36	85	73	66	7	7	7	7	7	7	7	7	7	7
1630	68	74	33	101	94	106	78	53	54	70	7	7	7	7	7	7	7	7	8	8
1640	96	107	104	136	134	103	142	131	50	183	11	11	11	11	11	11	11	11	12	12
1650	107	156	71	146	20	138	131	139	96	72	13	13	13	13	13	13	13	13	13	13
1660	105	86	81	70	67	50	68	74	77	60	13	13	13	13	13	13	13	13	13	13
1670	30	53	88	108	123	119	69	105	133	86	13	13	13	13	14	14	14	14	14	15
1680	113	125	157	137	82	11	32	134	105	85	16	17	17	17	17	17	17	17	17	17
1690	73	114	121	136	110	122	75	90	43	78	18	18	18	18	18	18	18	18	18	18
1700	68	139	99	72	80	87	120	86	100	82	18	18	18	19	19	19	19	19	19	19
1710	109	81	99	137	122	140	103	133	146	130	19	19	19	19	19	19	19	19	19	19
1720	175	125	58	109	44	133	124	105	48	18	19	19	19	19	19	19	19	19	19	19
1730	43	72	73	38	118	27	84	65	96	83	19	19	19	19	19	19	19	19	19	19
1740	58	76	69	91	104	97	119	163	67	168	19	19	19	19	19	19	19	19	19	19
1750	119	84	39	118	66	33	81	53	74	79	19	19	19	19	19	19	19	19	19	19
1760	77	53	81	83	93	114	116	108	132	130	20	20	20	20	20	20	20	20	20	20
1770	102	144	96	34	73	120	106	81	94	86	20	20	20	20	20	20	20	20	20	20
1780	16	99	77	105	75	82	78	97	55	55	20	20	20	20	20	20	20	20	20	20
1790	24	98	91	114	71	84	115	126	105	110	20	20	20	20	20	20	20	20	20	20
1800	122	63	128	76	88	54	52	94	71	83	20	20	20	20	20	20	20	20	20	20
1810	50	73	87	27	93	114	132	149	73	50	20	20	20	20	20	20	20	20	20	20
1820	72	126	87	98	119	116	126	104	133	128	20	20	20	20	20	20	20	20	20	20
1830	128	99	148	181	146	173	142	150	146	134	20	20	20	20	20	20	20	20	20	20
1840	165	141	146	126	160	51	182	68	134	138	20	20	20	20	20	20	20	20	20	20
1850	141	23	168	119	111	171	159	118	183	66	20	20	20	20	20	20	20	20	20	20
1860	109	2	154	120	49	110	114	111	110	131	20	20	20	20	20	20	20	20	20	20
1870	92	93	92	74	93	68	63	101	95	85	20	20	20	20	20	20	20	20	20	20
1880	82	72	86	60	111	105	93	69	100	106	20	20	20	20	20	20	20	20	20	20
1890	104	107	117	78	44	87	20	103	82	14	20	20	20	20	20	20	20	20	20	20
1900	63	81	23	74	28	84	73	91	106	128	20	20	20	20	20	20	20	20	20	20
1910	149	147	183	140	205	183	164	208	95	137	20	20	20	20	20	20	20	20	20	20
1920	154	116	168	80	79	92	133	116	141	126	20	20	20	20	20	20	20	20	20	20
1930	83	64	134	105	70	103	83	105	111	121	20	20	20	20	20	20	20	20	20	20
1940	132	153	195	106	162	124	92	97	135	178	20	20	20	20	20	20	20	20	20	20
1950	130	19	129	72	103	82	59	93	89	13	20	20	20	20	20	20	20	20	20	20
1960	75	66	65	59	77	83	90	82	75	88	20	20	20	20	20	20	20	20	20	20
1970	133	62	116								20	20	20							

SERIAL CORRELATION = .435 STANDARO OEVIATION = .410 MEAN SENSITIVITY = .381 N = 494

NAVAJO MOUNTAIN UT USA J.S. DEAN & D.O. BOWDEN
133099 PIED 26 3701N 11051W 2286M 503Y 1469:1971 20C SR: .22 SD: .41 MS: .49
AZ:270 SL:45 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

	TREE RING INOICES										NUMBER OF SAMPLES									
OATE	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
1469										94										1
1470	63	42	48	73	71	71	94	113	91	53	1	1	1	2	3	3	3	3	3	3
1480	99	91	124	88	134	93	109	60	85	87	3	3	3	3	3	4	4	4	4	4
1490	125	125	113	103	98	43	105	121	128	80	4	6	6	6	6	6	6	6	6	6
1500	44	130	128	158	158	98	97	111	96	174	6	6	6	6	6	6	6	6	6	6
1510	87	113	114	123	113	102	97	116	133	111	6	6	6	6	6	6	6	6	6	6
1520	91	78	33	80	98	83	137	96	82	90	6	6	6	6	6	6	6	6	6	6
1530	104	81	27	73	140	112	147	140	43	116	6	6	6	6	6	6	6	6	6	6
1540	103	100	5	110	61	73	132	122	96	174	6	6	6	6	7	7	7	7	7	7
1550	143	105	106	108	92	104	119	138	119	105	8	8	9	9	9	9	9	9	9	9
1560	109	81	105	81	126	148	140	101	114	101	9	9	9	9	9	9	9	9	9	9
1570	91	65	89	57	52	91	82	129	96	71	9	9	9	9	9	9	9	9	9	9
1580	50	95	62	37	9	20	121	145	156	122	9	9	9	9	9	9	9	9	10	10
1590	60	78	78	81	123	96	118	65	68	122	10	10	10	10	10	10	10	10	10	10
1600	13	90	156	131	133	129	120	82	73	137	10	10	10	10	10	10	10	12	12	12
1610	132	118	84	64	135	168	136	133	119	137	13	13	13	13	13	13	13	13	13	13
1620	142	178	139	47	93	103	47	147	73	87	13	13	13	13	13	13	13	13	13	13
1630	61	106	14	141	90	128	49	38	59	110	13	13	13	13	14	14	14	14	14	14
1640	132	144	101	102	125	87	101	129	41	133	14	14	14	14	14	14	14	14	14	14
1650	119	166	93	164	14	145	121	103	44	78	14	14	14	14	14	14	14	14	14	14
1660	137	151	80	68	90	65	74	59	61	66	14	14	14	14	14	14	14	14	14	14
1670	12	101	78	79	100	70	18	110	66	56	14	14	14	14	14	14	14	14	14	14
1680	114	120	83	141	62	1	31	129	85	92	14	14	14	14	14	14	14	14	14	14
1690	96	77	142	128	51	104	42	68	67	87	14	14	14	14	14	14	14	14	14	14
1700	75	128	68	18	92	114	85	71	44	128	16	16	16	16	16	16	16	16	16	16
1710	130	108	118	107	116	103	89	111	145	123	16	16	16	16	16	16	16	16	16	16
1720	163	110	26	135	62	132	155	119	6	50	16	16	16	16	16	16	16	16	16	16
1730	69	106	128	73	89	2	67	74	102	49	16	16	16	16	16	16	16	16	16	16
1740	64	137	71	113	50	113	144	151	57	149	16	16	16	16	16	16	16	16	16	16
1750	85	42	24	71	77	38	86	39	84	68	16	16	16	16	16	16	16	16	16	16
1760	127	92	108	79	149	30	154	106	144	39	16	16	16	16	16	16	16	16	16	16
1770	72	144	96	9	116	101	80	103	38	120	16	16	16	16	16	16	16	16	16	16
1780	101	107	53	87	166	117	97	165	101	100	18	18	18	18	18	18	18	18	18	18
1790	34	127	124	142	97	150	102	120	102	120	18	18	18	18	18	18	18	18	18	18
1800	114	55	103	82	117	71	50	172	121	165	18	18	18	18	18	18	18	18	18	18
1810	70	169	92	15	108	141	158	108	65	87	18	18	18	18	18	18	18	18	18	18
1820	86	150	29	121	158	151	192	140	200	119	19	19	19	19	19	19	20	20	20	20
1830	129	133	120	156	71	148	104	186	222	203	20	20	20	20	20	20	20	20	20	20
1840	210	167	89	109	152	41	137	14	113	218	20	20	20	20	20	20	20	20	20	20
1850	170	97	142	94	100	98	119	64	101	87	20	20	20	20	20	20	20	20	20	20
1860	61	2	156	102	20	98	151	127	147	140	20	20	20	20	20	20	20	20	20	20
1870	42	61	95	71	100	85	76	104	106	5	20	20	20	20	20	20	20	20	20	20
1660	51	78	7	62	127	151	132	42	114	149	20	20	20	20	20	20	20	20	20	20
1690	153	126	144	88	71	115	4	119	108	0	20	20	20	20	20	20	20	20	20	20
1900	53	68	7	167	16	135	138	160	161	143	20	20	20	20	20	20	20	20	20	20
1910	96	133	155	147	157	139	151	129	83	154	20	20	20	20	20	20	20	20	20	20
1920	184	114	161	174	105	99	155	136	118	99	20	20	20	20	20	20	20	20	20	20
1930	77	69	146	94	57	124	72	91	128	110	20	20	20	20	20	20	20	20	20	20
1940	84	132	117	63	84	88	27	63	99	123	20	20	20	20	20	20	20	20	20	20
1950	68	26	151	64	93	36	33	118	93	2	20	20	20	20	20	20	20	20	20	20
1960	105	95	69	19	69	103	111	81	62	114	20	20	20	20	20	20	19	18	18	27
1970	70	18									27	27								

SERIAL CORRELATION = .219 STANDARD DEVIATION = .411 MEAN SENSITIVITY = .492 N = 503

SAN GORGONIO CA USA R. TOSH
323598 PIFL 33 3406N 11650W 3048M 2012Y -42:1970 32C SR: .55 SD: .25 MS: .20
AZ:999 SL:99 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

	TREE RING INDICES										NUMBER OF SAMPLES									
DATE	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
7950									58	43									1	1
7960	41	37	48	29	12	14	30	28	32	71	1	1	1	1	1	1	1	1	1	1
7970	19	37	37	56	79	66	88	104	135	97	1	1	1	1	1	1	1	1	1	1
7980	66	100	80	64	88	83	122	83	110	116	1	1	1	2	2	2	3	3	3	4
7990	114	84	105	106	138	125	129	150	139	150	4	4	4	4	4	4	4	4	4	4
8000	157	135	114	123	81	70	91	95	94	78	4	4	4	4	4	4	4	4	4	4
8010	86	93	78	100	111	82	83	84	75	74	4	4	4	4	4	4	4	4	4	4
8020	56	70	60	67	84	109	123	133	129	114	4	4	4	4	4	4	5	5	5	5
8030	145	123	109	108	128	103	108	97	114	97	5	5	5	5	5	5	5	5	5	5
8040	115	99	67	70	59	89	70	78	61	118	5	5	5	5	5	5	5	5	5	5
8050	111	100	85	89	149	97	90	99	96	93	5	5	5	5	5	5	5	5	6	6
8060	79	93	87	93	70	59	79	88	109	79	6	6	6	6	6	6	6	6	7	7
8070	102	99	115	126	108	103	145	164	157	149	7	7	7	7	7	7	7	7	7	7
8080	147	144	153	130	110	72	89	71	97	107	7	7	7	7	7	7	7	7	7	7
8090	91	91	96	92	93	80	131	131	137	153	9	9	9	9	9	9	9	9	9	9
8100	98	117	121	105	112	88	105	107	72	36	9	9	9	9	9	9	9	8	8	8
8110	95	86	97	118	96	102	95	94	93	84	8	8	8	8	8	8	8	8	8	8
8120	56	101	71	44	94	110	112	107	93	89	8	8	8	7	7	7	7	7	7	7
8130	99	75	107	80	97	89	114	83	80	83	7	7	7	7	7	7	7	7	7	7
8140	88	93	87	33	93	86	91	66	89	102	7	7	7	7	7	7	7	7	7	7
8150	74	124	109	104	103	152	174	145	98	73	7	7	7	7	7	7	7	7	7	7
8160	133	112	116	135	105	69	122	126	93	114	7	7	7	7	7	7	7	7	8	8
8170	124	124	106	79	37	78	28	94	80	80	8	8	8	8	8	8	8	8	8	8
8180	83	98	81	104	107	106	112	117	106	106	9	9	9	9	9	9	9	9	9	9
8190	94	118	117	109	113	114	121	164	105	121	9	9	9	9	9	9	9	9	9	9
8200	89	105	108	127	130	124	133	105	105	120	9	9	10	10	10	10	10	10	10	10
8210	94	124	113	101	88	67	110	110	98	104	10	10	10	10	10	10	10	10	10	10
8220	91	90	78	82	109	100	93	101	111	68	10	10	10	10	10	10	10	10	10	11
8230	74	44	118	84	114	29	81	116	84	105	11	11	11	11	11	11	11	11	11	11
8240	112	86	89	74	95	57	111	108	94	119	11	11	11	11	11	11	11	11	11	11
8250	111	100	122	95	133	99	80	97	85	96	11	11	11	11	11	11	11	11	11	11
8260	116	82	46	101	112	108	94	109	127	102	11	11	11	11	11	11	11	11	11	11
8270	117	104	111	119	80	119	136	102	106	29	11	11	11	11	11	11	11	11	11	11
8280	127	100	86	111	93	92	107	107	118	112	11	11	11	11	11	11	11	11	11	11
8290	98	65	89	64	13	119	98	89	93	84	11	11	11	11	11	11	11	11	11	11
8300	87	87	47	81	115	115	73	55	91	82	11	11	11	11	11	10	10	10	10	10
8310	84	108	69	87	97	70	71	102	86	78	10	10	10	10	10	10	10	10	10	10
8320	97	53	108	73	76	108	101	109	91	108	10	10	10	10	10	10	10	10	10	10
8330	127	109	117	101	105	144	113	118	110	110	10	10	10	10	10	10	10	10	10	10
8340	55	124	115	146	111	120	106	117	108	129	10	10	10	10	9	9	9	9	9	9
8350	139	125	112	116	97	132	108	78	118	110	9	9	9	9	9	9	9	9	9	9
8360	88	40	104	83	71	83	76	72	68	46	9	9	9	9	9	8	8	8	8	8
8370	83	97	113	93	89	83	71	85	96	111	8	8	8	8	8	8	8	8	8	8
8380	118	116	98	94	89	72	90	97	105	107	8	8	8	8	8	8	8	8	8	8
8390	90	102	100	94	93	102	77	99	73	113	8	8	8	8	8	8	8	8	8	8
8400	87	92	40	74	58	80	95	86	84	80	8	8	8	8	8	8	6	8	8	7
8410	63	81	21	98	81	56	64	110	74	69	7	7	7	7	7	7	7	7	7	7
8420	97	79	112	116	107	95	58	93	77	103	7	7	7	7	7	7	7	7	7	7
8430	105	84	128	129	86	88	98	49	112	97	7	7	7	7	7	7	7	7	7	7
8440	89	82	38	92	98	98	83	38	92	51	7	7	7	7	7	6	6	6	6	6
8450	95	38	81	100	97	60	89	84	80	85	6	6	6	6	6	6	6	6	6	6
8460	93	107	102	55	90	112	108	84	100	106	6	6	6	6	6	7	7	7	7	7
8470	110	70	68	99	54	92	121	117	105	139	7	7	7	7	7	7	8	8	8	8
8480	121	85	90	91	122	119	82	102	101	148	8	8	8	8	8	8	8	8	8	8
8490	117	109	130	103	141	164	152	133	139	147	8	8	8	8	8	8	8	8	8	8
8500	162	116	130	144	182	122	72	76	101	132	8	8	8	8	8	8	8	7	7	7
8510	103	84	29	29	91	88	61	67	52	80	7	7	7	7	7	7	7	7	7	7
8520	59	114	120	104	95	50	63	29	94	108	7	7	7	7	7	7	7	7	7	7
8530	108	85	119	83	86	76	67	111	84	100	7	7	7	7	7	7	7	7	7	7
8540	107	106	88	59	51	53	87	104	107	104	7	7	7	7	7	7	7	7	7	7
8550	89	99	99	82	77	107	93	95	95	67	7	7	7	7	7	7	7	7	7	7
8560	119	107	89	26	107	64	109	94	95	79	7	7	7	7	7	7	7	7	7	7
8570	68	115	113	127	105	104	116	119	119	133	7	7	7	7	7	7	7	7	7	7
8580	142	142	129	133	119	160	129	132	92	103	7	7	7	7	7	7	7	7	7	7
8590	58	60	104	123	87	120	86	113	115	91	7	7	7	7	7	7	7	7	7	7
8600	141	112	96	81	96	116	95	74	107	97	7	7	7	7	7	6	6	6	6	6
8610	85	33	87	60	91	61	77	69	88	95	6	6	6	6	6	6	6	6	6	6
8620	72	95	94	94	92	95	120	79	92	85	6	6	6	6	6	6	6	6	6	6
8630	68	92	106	119	120	115	154	96	94	95	6	6	6	6	6	6	6	6	6	6
8640	55	104	100	78	34	65	76	64	75	86	6	6	6	6	6	6	6	6	6	6
8650	76	31	100	85	76	105	101	109	111	109	6	6	6	6	6	6	6	6	6	6
8660	69	90	121	122	113	110	133	128	94	96	6	6	6	6	6	6	6	6	6	6
8670	91	111	112	106	105	89	87	78	90	92	7	7	7	7	7	7	7	7	7	7
8680	107	82	110	100	94	84	92	89	78	91	7	7	7	7	7	7	7	7	7	7
8690	77	104	87	105	72	114	86	105	92	22	7	7	7	7	7	7	7	7	7	7
8700	116	111	83	90	60	100	47	77	88	39	7	7	6	6	6	6	6	6	6	6
8710	81	68	70	88	84	98	113	80	93	80	6	6	6	6	6	6	6	6	6	6
8720	66	88	81	99	75	80	92	88	91	89	6	6	6	6	6	6	6	6	6	5
8730	85	91	77	69	61	62	76	112	55	57	5	5	5	5	5	5	5	5	5	5
8740	49	50	60	49	41	79	66	63	57	72	5	5	5	5	5	5	5	5	5	5
8750	70	57	67	91	92	92	73	92	115	79	5	5	5	5	5	5	5	5	5	5
8760	74	83	88	83	86	100	81	102	76	69	5	5	5	5	5	5	5	5	5	5
8770	70	97	67	87	80	104	72	86	44	39	5	5	5	5	5	5	5	5	5	5
8780	79	85	38	124	113	82	98	99	77	85	5	5	5	5	5	5	5	5	5	5
8790	84	85	50	68	83	96	78	77	113	63	5	5	5	5	5	5	5	5	5	5
8800	84	91	119	154	99	109	134	101	94	18	5	5	5	5	5	5	6	6	6	6

San Gorgonio, cont.

8810	107	114	120	99	118	128	135	90	108	97	6	6	6	6	6	6	6	6	6	6
8820	160	177	186	111	96	155	162	146	157	156	5	5	5	5	5	5	5	5	5	5
8830	114	157	173	134	117	127	124	104	117	55	5	5	5	5	5	5	5	5	5	5
8840	94	66	120	160	104	103	122	103	109	98	5	5	5	5	5	5	5	5	5	5
8850	105	125	136	129	151	134	140	134	144	[illegible]	5	5	5	5	5	5	5	5	5	5
8860	132	140	161	147	160	134	138	70	82	129	5	5	6	6	6	6	6	6	6	6
8870	110	109	121	122	135	139	136	107	115	111	6	6	6	6	6	6	6	6	6	6
8880	115	138	140	129	87	161	127	140	145	141	6	6	6	6	6	6	6	6	6	6
8890	162	223	205	189	197	138	142	163	162	156	6	6	6	6	6	6	6	6	6	6
8900	99	166	111	134	138	147	120	127	129	125	6	6	6	6	6	6	6	6	6	6
8910	109	133	132	88	108	130	123	132	100	112	6	6	6	6	6	6	6	6	7	7
8920	61	104	57	58	29	113	92	107	98	109	7	7	7	7	7	7	7	7	7	7
8930	93	119	89	97	102	87	25	134	107	98	7	7	7	7	7	7	7	7	7	7
8940	105	144	144	94	99	129	123	131	91	111	7	8	8	8	8	8	8	8	8	8
8950	133	82	89	116	70	112	90	56	97	92	8	8	8	8	8	8	8	8	8	8
8960	97	76	115	111	95	109	109	87	79	87	8	8	8	8	8	8	8	8	8	8
8970	99	88	89	118	92	89	98	106	71	45	8	8	8	8	8	8	8	8	8	8
8980	40	31	83	77	76	67	70	93	103	84	8	8	8	8	8	8	8	8	8	7
8990	76	89	110	95	77	35	105	75	98	76	7	7	7	7	7	7	7	7	8	8
9000	105	83	85	73	91	64	75	80	99	95	8	8	8	8	8	8	8	8	8	8
9010	91	116	92	108	95	122	94	104	112	98	8	8	8	8	8	8	8	8	8	8
9020	84	110	89	125	106	89	84	102	97	77	8	8	8	8	8	8	8	8	8	8
9030	112	110	99	70	93	98	94	103	106	92	8	8	8	8	8	8	8	8	8	8
9040	102	111	100	111	124	125	120	101	92	109	8	8	8	8	8	8	8	9	9	9
9050	123	121	135	111	102	96	131	143	99	107	9	9	9	9	9	9	9	9	9	9
9060	100	120	66	100	109	113	90	98	102	100	9	9	9	9	9	9	9	9	9	9
9070	112	119	97	96	85	120	112	132	107	104	9	9	9	9	9	9	9	9	9	9
9080	118	123	89	90	100	120	90	101	109	109	9	9	9	9	9	9	9	9	9	9
9090	97	74	88	70	78	83	75	103	66	67	9	9	9	9	9	9	9	9	10	10
9100	104	85	92	79	105	93	80	107	90	108	10	10	10	10	10	10	10	10	10	10
9110	97	91	89	61	72	72	91	93	104	89	10	10	10	10	10	10	10	10	10	10
9120	73	42	103	87	79	84	46	52	75	102	10	10	11	11	11	11	11	11	11	11
9130	66	81	63	60	45	71	68	79	73	82	11	11	11	11	11	11	11	11	11	11
9140	100	91	69	71	83	88	60	81	68	76	11	12	12	12	12	12	12	12	12	12
9150	68	66	73	82	68	82	55	90	65	101	12	12	12	13	13	13	13	13	13	13
9160	78	95	83	111	95	112	106	97	83	92	13	13	13	13	13	13	13	[illegible]	13	14
9170	53	80	78	82	71	69	72	76	69	43	14	14	14	14	14	14	14	[illegible]	14	14
9180	81	77	65	76	100	80	77	81	83	92	14	14	14	14	14	14	14	[illegible]	14	14
9190	82	90	86	93	104	117	86	99	105	92	14	14	14	14	14	14	14	14	14	14
9200	84	94	104	101	135	122	93	109	100	115	14	14	14	14	15	15	15	15	15	15
9210	109	104	109	95	77	72	88	74	63	89	15	15	15	15	16	16	16	16	16	16
9220	106	81	94	89	92	92	66	47	91	103	16	16	16	16	16	16	16	16	16	16
9230	72	85	120	80	87	75	59	74	102	116	17	17	17	18	18	18	18	18	18	18
9240	90	96	91	103	79	91	83	81	101	108	18	18	18	18	18	18	18	18	18	18
9250	91	55	100	91	67	72	87	87	81	100	18	18	18	18	18	18	18	18	18	18
9260	115	111	106	80	75	101	87	87	93	103	18	18	18	18	18	18	18	18	18	18
9270	102	114	99	102	90	121	60	87	116	97	18	18	18	18	18	19	19	19	19	19
9280	86	96	114	103	71	43	69	45	59	79	19	19	19	19	19	19	19	19	19	19
9290	71	82	71	75	84	[illegible]	34	74	81	55	19	19	19	19	19	20	20	20	20	20
9300	89	81	84	93	98	[illegible]	91	85	86	94	20	20	20	20	20	20	20	20	20	20
9310	91	95	121	120	106	91	99	110	94	127	20	20	20	20	20	20	20	20	20	20
9320	106	114	97	86	95	97	94	122	98	90	20	20	20	20	20	20	20	20	20	20
9330	96	131	121	131	128	89	85	93	39	61	20	20	20	20	20	20	20	20	20	20
9340	84	84	85	106	113	110	114	89	94	104	20	20	20	20	20	20	20	20	20	20
9350	86	75	103	112	99	95	109	99	71	126	20	20	20	20	20	20	20	20	20	20
9360	103	91	105	129	107	108	129	122	126	134	20	20	20	20	20	20	20	20	20	20
9370	121	97	125	129	108	133	133	103	115	67	20	20	20	20	20	20	20	20	20	20
9380	150	150	132	133	118	143	119	133	136	160	20	20	20	20	20	20	20	20	20	20
9390	143	118	146	158	148	126	95	104	113	132	20	20	20	20	20	20	20	20	20	20
9400	139	121	116	132	121	105	118	59	123	123	20	20	20	20	20	20	20	20	20	20
9410	107	114	104	56	106	105	118	107	115	95	20	20	20	20	20	20	20	20	20	20
9420	129	93	96	120	119	89	110	118	132	136	20	20	20	20	20	20	20	20	20	20
9430	99	113	96	138	99	106	127	104	93	93	20	20	20	20	20	20	20	20	20	20
9440	91	136	101	110	83	122	94	99	83	91	20	20	20	20	20	20	20	20	20	20
9450	63	91	77	109	106	104	98	89	109	108	20	20	20	20	20	20	20	20	20	20
9460	93	125	132	129	89	85	129	125	113	110	20	20	20	20	20	20	20	20	20	20
9470	132	114	120	106	127	106	116	135	139	97	20	20	20	20	20	20	20	20	20	20
9480	112	146	127	115	137	110	121	115	126	140	20	20	20	20	20	20	20	20	20	20
9490	110	99	77	82	104	111	89	54	119	103	20	20	20	20	20	20	20	20	20	20
9500	109	107	104	107	109	108	97	98	124	142	20	20	20	20	20	20	20	20	20	20
9510	102	101	112	83	118	112	126	121	101	110	20	20	20	20	20	20	20	20	20	20
9520	79	73	92	92	110	98	127	129	113	100	20	20	20	20	20	20	20	20	20	20
9530	99	109	117	106	110	117	122	121	109	132	20	20	20	20	20	20	20	20	20	20
9540	114	102	91	101	101	90	122	94	87	111	20	20	20	20	20	20	20	20	20	20
9550	118	128	111	106	104	101	128	131	126	85	20	20	20	20	20	20	20	20	20	20
9560	116	97	111	116	118	118	100	127	124	121	20	20	20	20	20	20	20	20	20	20
9570	102	50	62	81	87	78	95	98	77	87	20	20	20	20	20	20	20	20	20	20
9580	78	126	108	105	67	54	92	96	85	128	20	20	20	20	20	20	20	20	20	20
9590	69	84	90	102	115	103	105	83	112	103	20	20	20	20	20	20	20	20	20	20
9600	107	93	91	86	107	99	79	86	99	113	20	20	20	20	20	20	20	20	20	20
9610	105	98	88	50	116	86	105	101	112	80	20	20	20	20	20	20	20	20	20	20
9620	100	91	89	76	60	82	65	85	76	81	20	20	20	20	20	20	20	20	20	20
9630	86	80	75	57	74	90	98	87	82	86	20	20	20	20	20	20	20	20	20	20
9640	97	80	78	79	87	93	81	88	81	92	20	20	20	20	20	20	20	20	20	20
9650	76	112	100	65	55	55	100	96	99	97	20	20	20	20	20	20	20	20	20	20
9660	105	91	88	73	88	68	67	75	67	56	20	20	20	20	20	20	20	20	20	20
9670	76	100	82	88	94	65	61	88	79	94	20	20	20	20	20	20	20	20	20	20
9680	119	84	110	123	109	101	95	103	110	124	20	20	20	20	20	20	20	20	20	20
9690	91	102	123	97	122	119	87	85	84	92	20	20	20	20	20	20	20	20	20	20
9700	92	40	94	54	80	93	78	46	83	86	20	20	20	20	20	20	20	20	20	20
9710	74	85	88	72	66	73	30	82	90	87	20	20	20	20	20	20	20	20	20	20
9720	106	89	76	87	99	106	117	96	96	76	20	20	20	20	20	20	20	20	20	20
9730	85	100	111	89	92	57	82	76	101	66	20	20	20	20	20	20	20	20	20	20

San Gorgonio, cont.

9740	94	109	65	109	101	105	121	141	107	103	20	20	20	20	20	20	20	20	20	20
9750	105	118	77	56	96	91	103	84	98	84	20	20	20	20	20	20	20	20	20	20
9760	108	72	87	89	90	75	99	105	97	111	20	20	20	20	20	20	20	20	20	20
9770	98	121	109	91	120	133	108	76	101	104	20	20	20	20	20	20	20	20	20	20
9780	86	103	47	87	105	81	92	[illegible]	74	110	20	20	20	20	20	20	20	20	20	20
9790	77	112	121	102	81	86	98	[illegible]	96	105	20	20	20	20	20	20	20	20	20	20
9800	91	90	103	102	129	112	109	65	110	92	20	20	20	20	20	20	20	20	20	20
9810	81	109	90	82	96	95	87	108	113	99	20	20	20	20	20	20	20	20	20	20
9820	90	136	80	46	100	117	100	107	114	94	20	20	20	20	20	20	20	20	20	20
9830	108	105	141	132	123	119	96	106	132	144	20	20	20	20	20	20	20	20	20	20
9840	121	103	71	71	101	84	118	84	117	131	20	20	20	20	20	20	20	20	20	20
9850	130	106	122	126	117	120	98	22	111	111	20	20	20	20	20	20	20	20	20	20
9860	114	91	130	105	92	102	128	129	155	133	20	20	20	20	20	20	20	20	20	20
9870	137	121	123	109	153	109	121	96	101	75	20	20	20	20	20	20	20	20	20	20
9880	75	81	90	81	105	74	96	100	108	120	20	20	20	20	20	20	20	20	20	20
9890	140	128	127	122	82	120	91	111	93	83	20	20	20	20	20	20	20	20	20	20
9900	91	115	83	105	94	117	111	131	112	123	20	20	20	20	20	20	20	20	20	20
9910	148	150	119	119	155	144	148	123	159	128	20	20	20	20	20	20	20	20	20	20
9920	154	135	174	125	136	125	147	139	121	84	20	20	20	20	20	20	20	20	20	20
9930	135	132	141	88	79	115	102	134	155	114	20	20	20	20	20	20	20	20	20	20
9940	126	140	123	140	99	96	118	110	90	103	20	20	20	20	20	20	20	20	20	20
9950	81	78	97	99	105	91	76	112	120	98	20	20	20	20	20	20	20	20	20	20
9960	90	49	100	104	114	104	114	123	114	159	20	20	20	20	20	20	20	20	20	20
9970	137										19									

BETATAKIN CANYON I. AZ DSA SCHULMAN, DEAN & BOWDEN
151099 PSME 36 3641N 11032W 2042M 471Y 1500:1970 20C SR: .33 SD: .47 MS: .52
AZ:340 SL:35 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

TREE RING INDICES

DATE	0	1	2	3	4	5	6	7	8	9
1500	15	57	83	94	138	55	29	99	132	196
1510	62	159	133	133	167	116	103	30	45	91
1520	118	88	0	69	77	65	201	78	54	56
1530	91	95	17	75	71	103	90	88	19	81
1540	142	99	3	68	20	81	103	76	98	109
1550	111	89	86	116	92	74	125	143	105	99
1560	108	86	80	99	211	131	85	126	103	138
1570	114	77	97	56	52	116	108	136	117	75
1580	101	133	92	37	37	12	79	75	135	121
1590	47	34	28	42	132	101	88	70	74	125
1600	58	77	111	103	120	141	117	52	101	136
1610	158	134	64	41	57	146	157	166	180	177
1620	128	222	154	35	72	121	44	115	89	116
1630	68	107	18	143	132	128	77	39	57	149
1640	150	187	175	139	176	88	185	153	66	196
1650	150	175	93	158	14	117	99	107	88	95
1660	122	133	78	81	76	71	92	80	53	53
1670	17	61	73	97	117	93	55	115	104	48
1680	117	148	148	161	42	5	28	111	96	89
1690	82	110	130	146	65	139	82	61	101	94
1700	79	138	85	44	84	139	111	76	88	73
1710	112	64	95	115	134	100	74	94	108	137
1720	234	192	80	152	47	201	260	112	28	9
1730	51	76	81	32	75	17	96	33	103	40
1740	58	74	52	117	115	123	166	216	51	163
1750	101	99	116	41	65	37	70	13	108	125
1760	128	84	144	56	136	101	148	67	141	146
1770	49	123	65	8	57	88	94	64	13	73
1780	40	70	21	89	78	83	68	104	87	41
1790	5	112	109	142	59	124	108	94	113	108
1800	82	95	93	74	93	96	79	103	39	82
1810	25	62	93	7	77	98	142	152	28	27
1820	14	119	26	65	69	96	110	61	108	52
1830	117	130	74	147	95	147	102	140	174	209
1840	208	121	67	81	155	11	153	19	142	151
1850	168	76	156	83	72	130	117	51	84	73
1860	91	8	133	98	35	83	102	107	145	183
1870	89	54	34	65	108	113	94	124	136	134
1880	88	45	90	38	115	111	100	51	152	146
1890	200	203	192	101	63	114	29	119	110	2
1900	101	56	3	78	6	78	69	105	110	120
1910	130	148	187	123	168	192	173	214	83	174
1920	218	171	211	137	152	105	162	91	135	109
1930	62	163	150	56	61	89	36	97	118	94
1940	115	150	167	110	161	90	113	84	195	181
1950	96	26	157	106	11[illegible]	59	54	140	122	13
1960	102	86	75	60	6[illegible]	166	176	103	162	155
1970	136									

NUMBER OF SAMPLES

DATE	0	1	2	3	4	5	6	7	8	9
1500	1	1	1	1	1	1	1	1	1	1
1510	1	1	1	1	1	1	1	1	1	1
1520	1	1	1	1	1	1	1	1	1	1
1530	2	2	2	2	2	2	2	2	2	2
1540	2	2	2	2	2	2	2	2	2	2
1550	4	4	4	4	4	5	5	5	5	5
1560	5	5	6	6	6	6	7	7	7	8
1570	9	9	9	9	9	9	9	9	9	9
1580	9	9	9	9	9	9	9	9	9	9
1590	9	9	9	9	9	9	9	9	9	9
1600	12	12	12	12	12	13	13	13	13	13
1610	14	14	14	14	14	14	14	14	14	14
1620	14	14	14	14	14	14	14	14	14	14
1630	14	14	14	14	15	15	15	15	15	15
1640	16	16	16	16	16	16	16	16	16	16
1650	16	16	16	16	16	16	16	16	16	16
1660	16	16	16	16	16	17	17	17	17	17
1670	17	17	17	18	18	18	18	18	18	18
1680	18	18	18	18	18	18	18	18	18	18
1690	18	18	18	18	18	18	18	18	18	18
1700	18	18	18	18	19	19	19	19	19	19
1710	19	19	19	19	19	19	19	19	19	19
1720	19	19	19	19	19	19	19	19	19	19
1730	20	20	20	20	20	20	20	20	20	20
1740	20	20	20	20	20	20	20	20	20	20
1750	20	20	20	20	20	20	20	20	20	20
1760	20	20	20	20	20	20	20	20	20	20
1770	20	20	20	20	20	20	20	20	20	20
1780	20	20	20	20	20	20	20	20	20	20
1790	20	20	20	20	20	20	20	20	20	20
1800	20	20	20	20	20	20	20	20	20	20
1810	20	20	20	20	20	20	20	20	20	20
1820	20	20	20	20	20	20	20	20	20	20
1830	20	20	20	20	20	20	20	20	20	20
1840	20	20	20	20	20	20	20	20	20	20
1850	20	20	20	20	20	20	20	20	20	20
1860	20	20	20	20	20	20	20	20	20	20
1870	20	20	20	20	20	20	20	20	20	20
1880	20	20	20	20	20	20	20	20	20	20
1890	20	20	20	20	20	20	20	20	20	20
1900	20	20	20	20	20	20	20	20	20	20
1910	20	20	20	20	20	20	20	20	20	20
1920	20	20	20	20	20	20	20	20	20	20
1930	20	20	20	20	20	20	20	20	20	20
1940	20	20	20	20	20	20	20	20	20	20
1950	20	20	20	20	20	20	20	20	20	20
1960	20	20	20	20	20	20	20	20	20	20
1970	20									

SERIAL CORRELATION = .326 STANDARD DEVIATION = .472 MEAN SENSITIVITY = .524 N = 471

SATAN PASS NM USA DEAN BOWDEN ROBINSON, BURNS
161000 PSME 38 3536N 10808W 2286M 592Y 1381:1972 24C SR: .46 SD: .61 MS: .57
A7:335 SL:30 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

	TREE RING INDICES										NUMBER OF SAMPLES									
DATE	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
1381		435	166	312	285	178	210	216	156	99		1	1	1	1	1	1	1	1	1
1390	41	61	100	51	73	80	63	28	26	12	1	1	1	1	1	1	1	1	1	1
1400	36	36	44	44	67	44	36	15	24	108	1	1	1	1	[illegible]	1	1	2	2	2
1410	159	163	296	84	214	106	194	238	103	39	2	2	2	2	2	2	2	2	2	2
1420	119	56	99	63	95	110	169	216	255	118	2	2	2	2	2	2	2	2	2	2
1430	103	233	216	242	167	117	56	74	32	69	2	2	2	2	2	2	2	2	2	2
1440	76	101	46	62	47	24	18	74	27	39	2	2	2	2	2	2	2	2	2	2
1450	19	78	89	104	52	4	74	11	129	83	2	2	2	2	2	2	2	2	2	2
1460	61	48	57	7	19	12	72	105	84	101	2	2	2	2	2	2	2	2	2	2
1470	94	32	39	49	13	38	45	66	16	10	2	2	2	2	2	2	2	2	2	2
1480	15	48	49	55	83	93	51	29	82	111	2	2	2	2	2	2	2	2	2	2
1490	84	176	126	91	82	7	28	59	113	108	2	2	2	2	2	2	2	2	2	2
1500	22	33	49	65	61	89	21	76	32	69	2	2	2	2	2	2	2	2	2	2
1510	51	133	138	133	194	178	98	19	105	149	2	2	2	2	2	2	2	2	2	2
1520	172	87	42	64	47	57	96	79	94	89	2	2	2	2	2	2	2	2	2	2
1530	135	152	109	89	68	85	76	130	31	103	2	2	2	2	2	2	2	2	2	2
1540	135	117	18	132	53	114	59	91	56	122	2	2	2	2	2	2	2	2	2	2
1550	129	45	58	98	38	85	128	165	115	87	2	2	2	2	2	2	2	2	2	2
1560	56	31	34	52	70	115	88	80	[illegible]	166	2	2	2	2	2	2	2	2	2	2
1570	146	94	97	40	58	59	43	101	[illegible]	41	2	2	2	3	3	3	3	3	3	3
1580	19	57	57	21	20	26	68	75	140	92	3	3	3	3	3	3	3	3	3	3
1590	41	136	34	28	178	155	137	134	75	113	4	4	4	4	4	4	4	4	4	4
1600	53	63	51	64	100	161	145	191	196	236	4	4	4	4	4	4	4	4	4	4
1610	369	340	246	262	123	205	202	218	273	166	4	4	5	5	5	5	5	5	5	5
1620	268	297	103	78	43	60	34	135	125	223	5	5	6	6	6	6	6	6	6	6
1630	187	100	75	164	193	125	106	57	79	144	7	7	7	7	7	8	9	9	9	9
1640	200	114	142	161	127	93	[illegible]	153	104	130	10	10	10	10	10	10	11	12	12	12
1650	94	162	144	139	86	120	141	69	93	35	15	15	16	16	16	16	16	16	16	16
1660	101	72	65	74	33	172	89	59	29	47	16	16	16	16	16	16	16	16	16	16
1670	17	101	35	100	32	102	32	86	78	51	16	16	16	16	16	16	16	17	17	17
1680	145	136	163	176	38	8	120	108	89	131	18	18	18	18	18	18	18	18	18	18
1690	183	145	179	175	119	124	47	31	66	131	18	18	18	18	18	18	18	18	18	18
1700	91	197	109	112	77	71	121	123	94	63	20	20	20	20	20	20	21	21	21	21
1710	181	147	169	129	106	92	16	100	78	93	21	21	22	22	22	22	22	22	22	22
1720	192	137	56	139	27	85	128	138	13	4	22	22	22	22	22	22	22	22	22	22
1730	66	100	131	46	86	12	82	61	34	74	24	24	24	24	24	24	24	24	24	24
1740	67	67	24	124	40	152	202	280	16	207	24	24	24	24	24	24	24	24	24	24
1750	98	95	35	63	133	66	68	66	128	187	24	24	24	24	24	24	24	24	24	24
1760	130	35	166	28	130	50	154	86	173	169	24	24	24	24	24	24	24	24	24	24
1770	138	159	120	21	87	66	96	25	79	58	24	24	24	24	24	24	24	24	24	24
1780	34	90	22	147	182	126	75	144	44	110	24	24	24	24	24	24	24	24	24	24
1790	95	139	159	189	93	169	74	84	99	69	24	24	24	24	24	24	24	24	24	24
1800	39	64	104	55	117	92	15	138	86	81	24	24	24	24	24	24	24	24	24	24
1810	45	44	56	52	90	91	206	187	26	14	24	24	24	24	24	24	24	24	24	24
1820	76	123	1	28	61	80	36	27	109	31	24	24	24	24	24	24	24	24	24	24
1830	96	83	109	142	171	167	113	169	204	248	24	24	24	24	24	24	24	24	24	24
1840	234	173	81	81	141	63	94	1	141	132	24	24	24	24	24	24	24	24	24	24
1850	116	56	146	87	38	187	197	63	123	93	24	24	24	24	24	24	24	24	24	24
1860	83	11	132	60	48	79	94	152	125	197	24	24	24	24	24	24	24	24	24	24
1870	98	114	20	109	154	49	57	182	71	102	24	24	24	24	24	24	24	24	24	24
1880	13	40	125	122	158	131	78	88	156	116	24	24	24	24	24	24	24	24	24	24
1890	90	141	105	54	28	117	55	99	68	33	24	24	24	24	24	24	24	24	24	24
1900	59	67	34	108	4	154	101	124	202	42	24	24	24	24	24	24	24	24	24	24
1910	124	108	134	60	131	178	157	145	45	149	24	24	24	24	24	24	24	24	24	24
1920	199	52	101	79	170	29	136	80	130	77	24	24	24	24	24	24	24	24	24	24
1930	78	120	147	71	55	209	124	162	116	114	24	24	24	24	24	24	24	24	24	24
1940	45	213	139	62	116	114	53	90	150	109	24	24	24	24	24	24	24	24	24	24
1950	32	17	113	41	27	16	34	35	91	38	24	24	24	24	24	24	24	24	24	24
1960	103	67	84	47	76	138	114	20	171	142	24	24	24	24	24	24	24	24	24	24
1970	152	36	110								24	24	23							

SERIAL CORRELATION = .461 STANDARD DEVIATION = .612 MEAN SENSITIVITY = .569 N = 592

ECHO AMPHITHEATER I. NM USA ROBINSON, BURNS & DEAN
17 099 PSME 39 3621N 10631W 2042M 611Y 1362:1972 20C SR: .41 SD: .56 MS: .49
AZ: 25 SL:35 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

	TREE RING INOICES										NUMBER OF SAMPLES									
OATE	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
1362			138	69	109	145	113	140	487	85			1	1	1	1	1	1	1	1
1370	242	290	396	333	314	265	44	211	219	205	1	1	1	1	1	1	1	1	1	1
1380	226	330	156	415	224	137	120	120	38	166	1	1	1	1	1	1	1	1	1	1
1390	51	89	101	80	138	184	184	175	199	25	1	1	1	1	1	1	1	1	1	1
1400	74	82	119	41	155	114	191	135	191	234	1	1	1	1	1	1	2	2	2	2
1410	238	102	220	107	233	98	88	147	82	81	2	2	2	2	2	2	2	2	2	2
1420	129	101	80	73	33	84	69	116	157	94	2	2	2	2	2	2	2	2	2	2
1430	51	114	60	86	123	123	103	48	3	133	2	2	2	2	2	2	2	2	2	2
1440	68	97	53	106	62	9	107	140	81	24	2	2	2	2	2	2	2	2	2	2
1450	32	56	50	60	28	26	63	20	82	86	2	2	2	2	2	2	2	2	2	2
1460	76	21	74	16	19	28	90	74	41	77	2	2	2	2	2	2	2	2	2	2
1470	134	20	87	54	43	50	50	77	74	97	2	2	2	2	2	2	2	2	2	2
1480	12	182	71	112	201	141	115	66	92	103	2	2	2	2	2	2	2	2	2	2
1490	65	129	113	108	138	19	59	69	192	191	2	2	2	2	2	2	2	2	2	3
1500	103	93	95	85	65	92	14	90	27	146	3	3	3	3	3	3	3	3	3	3
1510	43	102	144	232	208	218	10	15	134	64	3	3	3	3	3	3	3	3	3	3
1520	138	117	43	94	68	78	99	87	119	192	3	3	3	3	3	3	3	3	3	3
1530	116	168	50	78	107	44	82	137	36	98	3	3	3	3	3	3	3	3	3	3
1540	129	103	11	121	67	45	58	85	79	121	4	4	4	4	4	4	4	4	4	4
1550	167	70	118	101	73	117	103	115	85	42	4	4	4	4	4	4	4	4	4	4
1560	54	73	12	62	74	82	50	28	36	91	4	4	4	4	4	4	4	4	4	4
1570	137	79	109	20	70	63	65	103	52	21	4	4	4	4	4	4	4	4	4	5
1580	34	68	75	63	48	51	83	69	131	161	6	6	6	6	6	6	6	6	6	6
1590	73	141	87	17	144	144	147	161	64	105	7	7	7	9	8	8	8	8	8	8
1600	76	79	110	103	112	128	88	65	140	137	10	10	10	10	10	10	10	10	10	10
1610	223	200	153	214	126	63	93	156	174	95	10	10	10	10	10	10	10	10	10	10
1620	136	111	75	78	56	21	82	115	82	127	10	10	10	10	10	10	10	10	11	11
1630	136	98	74	87	110	114	128	79	40	148	11	11	11	11	11	11	11	11	11	11
1640	151	62	58	104	85	37	189	223	154	186	11	11	11	11	11	11	11	12	12	12
1650	148	197	127	135	81	178	104	53	62	53	12	12	12	12	12	12	12	12	12	12
1660	130	113	112	111	25	74	65	56	46	51	12	12	12	12	12	12	12	12	12	12
1670	97	74	77	133	88	89	37	83	56	66	13	13	13	13	13	13	13	14	14	14
1680	131	83	89	87	56	2	138	101	52	143	15	15	15	15	15	15	15	15	15	15
1690	139	124	118	129	60	82	34	75	77	94	15	15	15	15	15	15	15	15	15	15
1700	43	145	120	115	39	77	121	74	106	47	15	15	15	15	15	15	15	15	15	15
1710	196	121	142	112	30	93	23	103	89	44	16	16	16	16	16	16	16	16	16	16
1720	148	181	129	159	103	134	159	130	74	14	16	16	16	16	16	16	16	16	16	16
1730	108	92	105	72	79	46	117	45	34	53	16	16	16	16	16	16	16	16	16	16
1740	67	77	78	110	63	124	193	246	57	144	16	16	16	16	17	17	17	17	17	17
1750	93	86	53	73	127	88	28	43	88	108	17	17	17	17	17	17	17	17	17	17
1760	104	134	152	56	149	173	139	63	141	113	17	17	17	17	17	17	17	17	17	17
1770	170	252	189	65	80	77	118	62	99	56	17	17	17	17	17	17	17	17	17	17
1780	60	91	73	116	131	96	46	124	72	95	17	17	17	17	17	17	17	17	17	17
1790	65	108	120	158	120	121	81	109	104	68	17	18	18	18	18	18	18	18	18	19
1800	120	87	101	96	97	73	24	108	77	75	19	19	19	19	19	19	19	19	19	19
1810	53	72	66	79	75	118	186	167	69	25	19	19	19	19	19	19	19	19	19	19
1820	105	158	53	75	94	120	136	97	159	54	19	19	19	19	19	19	19	20	20	20
1830	87	112	122	118	98	132	85	136	151	187	20	20	20	20	20	20	20	20	20	20
1840	203	131	84	80	100	102	53	40	94	96	20	20	20	20	20	20	20	20	20	20
1850	114	48	134	74	100	160	180	149	143	83	20	20	20	20	20	20	20	20	20	20
1860	94	10	126	94	65	107	93	151	156	198	20	20	20	20	20	20	20	20	20	20
1870	94	91	90	95	105	73	42	106	62	60	20	20	20	20	20	20	20	20	20	20
1880	23	51	102	88	122	128	122	85	162	122	20	20	20	20	20	20	20	20	20	20
1890	78	146	134	82	90	135	22	128	108	10	20	20	20	20	20	20	20	20	20	20
1900	32	74	12	94	25	92	109	146	120	53	20	20	20	20	20	20	20	20	20	20
1910	81	78	148	33	129	154	132	102	83	148	20	20	20	20	20	20	20	20	20	20
1920	209	123	146	81	133	57	136	105	89	59	20	20	20	20	20	20	20	20	20	20
1930	113	63	155	101	87	148	111	170	167	99	20	20	20	20	20	20	20	20	20	20
1940	102	192	200	113	152	120	80	89	143	146	20	20	20	20	20	20	20	20	20	20
1950	59	53	70	56	58	41	23	58	85	36	20	20	20	20	20	20	20	20	20	20
1960	70	73	84	77	43	105	90	98	153	109	20	20	20	20	20	20	20	20	20	20
1970	134	44	88								20	20	18							

SERIAL CORRELATION = .410 STANDARD DEVIATION = .562 MEAN SENSITIVITY = .491 N = 611

SAN PEORO MARTIR (LOW) BAJ MEX STOKES, HARLAN & CLEMANS
337579 PIJE 40 3100N 11525W 2133M 523Y 1449:1971 41C SR: .28 SD: .28 MS: .29
AZ:999 SL:25 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

	TREE RING INOICES										NUMBER OF SAMPLES									
OATE	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
1449										100										1
1450	122	134	112	91	80	100	79	99	105	60	1	1	1	1	1	1	1	1	1	1
1460	105	86	99	107	130	73	114	118	101	96	2	2	2	3	3	3	3	3	3	3
1470	82	54	92	124	106	101	140	123	127	113	3	3	3	3	3	3	3	3	3	3
1480	100	107	93	111	118	112	72	105	89	123	3	4	4	4	4	4	4	4	4	4
1490	125	97	38	103	85	40	84	94	127	105	4	4	5	5	,5	5	5	5	5	5
1500	86	117	105	90	138	131	64	133	121	151	5	5	5	5	5	5	5	5	6	6
1510	44	146	102	128	111	99	84	93	95	135	6	6	7	7	7	7	7	7	7	7
1520	91	22	68	101	115	127	127	102	68	108	7	7	7	7	7	8	8	8	8	8
1530	117	109	98	100	106	96	112	111	72	132	8	8	8	8	8	8	8	8	8	8
1540	146	139	48	124	97	72	116	123	95	147	8	8	8	8	8	8	8	9	9	9
1550	128	106	117	93	100	114	106	76	75	89	9	9	9	9	9	9	9	9	9	9
1560	99	78	99	70	108	113	52	90	118	110	9	9	9	9	9	9	9	9	9	9
1570	100	86	98	46	35	61	84	78	80	48	9	9	9	9	9	9	9	9	9	10
1580	79	102	130	107	32	27	96	85	18	92	10	10	10	10	10	10	10	10	10	10
1590	48	69	73	97	93	102	124	66	124	123	10	10	10	10	10	10	10	10	10	10
1600	114	102	91	119	122	107	98	88	116	98	11	11	11	11	11	11	11	11	11	11
1610	147	123	79	10	104	113	101	123	105	95	11	11	11	11	11	11	12	12	12	12
1620	91	12[illegible]	100	68	65	111	51	98	111	123	13	13	13	13	13	13	14	14	14	14
1630	123	103	31	56	92	123	139	107	145	105	14	14	15	15	15	15	16	17	17	18
1640	131	119	106	97	126	114	111	125	49	125	19	19	19	19	19	19	20	20	20	20
1650	134	138	137	93	14	126	118	117	123	124	20	20	20	20	20	20	20	20	20	20
1660	144	131	147	165	125	31	135	108	92	57	20	21	21	21	21	21	21	22	22	22
1670	16	122	104	95	107	63	33	112	91	107	22	22	22	22	22	22	22	22	22	23
1680	118	123	124	124	109	115	115	118	128	131	23	23	23	23	23	24	24	24	24	24
1690	102	78	130	116	122	105	103	96	100	143	24	24	24	24	24	24	24	24	24	25
1700	120	132	120	59	100	116	104	104	104	80	25	25	25	25	25	25	25	25	25	25
1710	99	81	87	79	108	94	59	113	118	126	25	25	25	25	26	26	26	26	26	26
1720	127	134	130	144	118	140	156	100	94	82	26	26	27	27	27	28	28	29	29	29
1730	112	116	112	75	105	62	85	12[illegible]	118	86	29	29	29	29	29	29	29	29	29	29
1740	101	126	79	108	107	118	106	140	122	134	30	31	31	31	31	31	31	31	31	31
1750	123	98	14	41	26	57	74	71	103	120	31	31	31	31	31	31	32	32	32	32
1760	114	78	106	50	79	82	102	90	96	108	32	32	32	33	33	33	33	33	34	35
1770	96	106	128	125	122	134	111	88	73	89	35	35	35	35	35	35	35	35	35	35
1780	84	95	34	111	141	107	122	120	100	105	36	36	36	36	36	36	36	36	36	36
1790	65	110	140	133	107	99	85	74	93	112	36	36	36	36	36	36	36	36	36	36
1800	141	132	134	129	107	116	107	83	102	62	36	36	36	36	36	36	36	36	36	36
1810	117	113	99	95	96	104	121	120	128	91	36	36	36	36	36	36	36	36	36	36
1820	17	106	73	69	111	93	138	125	109	31	36	36	36	36	36	37	37	37	38	38
1830	78	75	90	94	98	106	110	103	113	114	38	38	38	38	38	38	38	38	38	38
1840	109	69	94	51	99	42	115	34	122	100	38	38	38	38	38	38	38	38	38	38
1850	121	106	106	127	122	129	126	98	117	103	38	38	38	38	38	38	38	38	38	38
1860	95	118	120	108	94	100	121	88	121	113	38	38	38	38	38	38	38	38	38	38
1870	91	75	72	74	96	91	83	69	101	61	38	38	38	38	38	38	38	38	38	38
1880	100	73	74	74	114	106	111	108	93	95	38	38	38	38	38	38	38	38	38	38
1890	127	130	131	112	83	97	101	103	85	64	38	37	37	37	37	37	37	37	37	37
1900	[illegible]8	86	53	76	54	115	102	116	120	140	37	37	37	37	37	37	37	37	37	37
1910	120	116	94	93	116	93	1	110	130	136	37	37	37	37	37	37	37	37	37	37
1920	114	78	127	85	95	73	[illegible]	106	81	46	37	35	35	35	35	35	35	35	35	35
1930	135	137	100	87	39	106	1[illegible]	96	104	92	35	35	35	35	35	35	35	35	35	35
1940	123	113	117	108	85	85	103	98	13	96	35	35	35	35	35	35	35	35	35	35
1950	62	89	83	103	109	72	38	121	126	137	35	35	35	34	34	34	34	34	34	34
1960	105	34	119	87	52	125	119	152	137	129	34	33	33	33	33	33	33	33	33	33
1970	164	79									33	33								

SERIAL CORRELATION = .278 STANOARO OEVIATION = .273 MEAN SENSITIVITY = .288 N = 523

KETCHUM & WARM SPRINGS ID USA C.W. FERGUSON
535549 PSME 45 4344N 11419W 1829M 445Y 1521:1965 26C SR: .50 SD: .30 MS: .24
AZ:999 SL:99 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

	TREE RING INDICES										NUMBER OF SAMPLES									
DATE	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
1521		33	32	38	47	67	64	51	61	6		1	1	1	1	1	1	1	1	1
1530	68	64	38	34	52	73	69	75	98	87	1	1	1	1	1	1	1	1	1	1
1540	61	50	72	69	92	80	116	131	138	163	1	1	1	1	1	1	1	1	1	1
1550	163	130	165	99	53	79	90	151	113	115	1	1	1	1	1	1	1	1	1	1
1560	114	113	100	87	162	87	106	77	107	109	1	1	1	1	1	1	1	1	1	1
1570	79	32	78	75	106	132	96	134	82	100	1	1	1	1	1	1	1	1	1	1
1580	46	56	86	110	62	73	92	89	50	74	1	1	1	1	1	1	1	1	1	1
1590	58	86	114	65	91	43	136	136	89	149	1	1	1	1	1	1	1	1	1	1
1600	65	109	80	78	119	106	152	106	180	140	1	1	1	1	1	1	1	1	1	1
1610	135	106	133	150	130	140	130	202	129	109	1	1	1	1	1	1	1	1	1	1
1620	87	194	137	119	158	135	71	94	92	69	1	1	1	1	1	1	1	1	1	1
1630	64	53	11	95	87	124	119	83	106	100	1	1	1	1	1	1	1	1	1	1
1640	121	151	207	181	129	129	112	110	86	140	1	1	1	1	1	1	1	1	1	1
1650	152	146	111	109	153	34	87	66	77	82	1	1	2	2	2	2	2	2	2	2
1660	70	102	96	91	104	69	106	57	107	103	2	2	2	2	2	2	2	2	2	2
1670	92	154	172	124	167	133	111	112	53	94	2	2	2	2	2	2	2	2	2	2
1680	82	98	112	78	113	117	108	185	110	145	2	2	2	2	2	2	2	2	2	2
1690	121	87	101	138	112	52	63	85	103	131	2	2	2	2	2	2	2	2	2	2
1700	157	126	167	71	98	102	90	106	83	78	2	2	2	2	2	2	2	2	2	3
1710	83	91	99	83	81	74	101	78	83	76	3	3	3	3	3	3	3	3	3	3
1720	99	46	71	82	91	80	101	99	122	75	3	3	3	4	4	4	5	5	5	5
1730	78	80	90	78	85	89	53	90	118	104	5	5	5	6	6	6	6	7	7	7
1740	99	111	95	99	82	112	130	108	105	140	7	7	7	7	7	7	7	7	7	7
1750	139	125	118	118	94	114	97	67	91	106	9	9	9	9	9	9	9	9	9	9
1760	118	142	105	85	105	87	130	152	128	116	9	9	9	9	10	10	10	10	11	11
1770	97	112	111	119	92	121	110	82	75	80	11	11	11	11	11	11	11	12	12	12
1780	101	74	52	53	74	76	82	93	77	114	14	14	14	14	14	14	14	14	14	14
1790	96	106	134	126	82	41	103	108	73	100	15	15	15	15	15	15	15	15	15	15
1800	74	84	97	121	89	101	100	80	93	89	16	16	16	16	16	16	16	17	17	17
1810	101	104	105	103	91	90	106	110	109	111	18	18	18	18	18	18	18	18	18	18
1820	120	136	70	70	72	94	108	105	152	95	18	18	19	19	19	20	20	20	20	20
1830	102	70	108	106	76	112	114	102	112	185	22	22	22	22	22	22	22	22	22	22
1840	99	85	79	118	85	94	79	90	102	104	25	25	25	25	25	25	25	25	25	25
1850	111	98	85	117	132	140	83	99	97	75	26	26	26	26	26	26	26	26	26	26
1860	128	115	96	116	73	74	139	98	129	107	26	26	26	26	26	26	26	26	26	26
1870	102	74	85	100	87	89	102	114	107	126	26	26	26	26	26	26	26	26	26	26
1880	95	111	99	113	99	116	84	89	94	71	26	26	26	26	26	26	26	26	26	26
1890	67	97	99	72	99	102	83	81	124	72	26	26	26	26	26	26	26	26	26	26
1900	99	89	66	73	90	97	112	144	151	112	26	26	26	26	26	26	26	26	26	26
1910	120	153	108	151	194	190	182	107	122	113	26	26	26	26	26	26	26	26	26	26
1920	91	105	98	127	83	123	98	87	90	81	26	26	26	26	26	26	26	26	26	26
1930	78	72	78	76	61	85	67	83	74	89	26	26	26	26	26	26	26	26	26	26
1940	89	95	111	82	96	100	92	102	86	88	26	26	26	26	26	26	26	26	26	26
1950	79	99	100	108	74	86	93	102	88	87	26	26	26	26	26	26	26	26	26	26
1960	74	70	80	116	101	123					26	26	26	26	26	26				

SERIAL CORRELATION = .495 STANDARD DEVIATION = .298 MEAN SENSITIVITY = .236 N = 445

OINNEBITO WASH I. AZ USA J.S. DEAN & V.C. LAMARCHE
113099 PIED 54 3610N 11030W 1920M 405Y 1567:1971 22C SR: .40 SD: .47 MS: .50
AZ:999 SL:10 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

OATE	TREE RING INOICES 0	1	2	3	4	5	6	7	8	9	NUMBER OF SAMPLES 0	1	2	3	4	5	6	7	8	9
1567								143	98	81								1	1	1
1570	111	110	95	86	80	123	96	145	125	81	1	1	1	1	1	1	1	1	1	1
1580	92	87	76	39	45	14	111	126	141	98	1	1	1	1	1	1	1	1	1	1
1590	53	59	62	123	153	108	116	80	62	105	1	1	1	1	1	1	1	1	1	1
1600	60	60	113	134	165	123	127	107	84	146	1	1	1	1	1	3	3	3	3	3
1610	137	133	49	29	91	114	91	129	89	67	4	4	4	4	4	4	4	4	4	4
1620	164	208	151	60	70	95	15	106	85	89	4	4	4	4	4	4	4	4	4	4
1630	70	8	39	105	106	135	108	64	59	99	4	4	4	4	4	5	5	5	5	5
1640	140	147	161	125	116	116	123	162	85	113	6	6	6	6	6	6	6	6	6	6
1650	139	173	141	108	12	168	164	87	46	103	6	6	6	6	6	6	6	6	6	6
1660	160	164	81	65	75	87	71	31	12	41	6	6	6	6	6	6	6	6	6	6
1670	30	59	93	116	123	62	39	106	77	44	8	8	8	8	8	8	8	8	8	8
1680	148	165	131	177	107	67	66	131	79	129	8	8	8	8	8	8	8	8	8	9
1690	102	109	120	119	72	138	76	75	124	122	10	10	10	10	10	10	11	11	11	11
1700	32	132	87	93	66	125	145	85	64	94	11	11	11	11	11	11	11	11	11	11
1710	114	94	91	84	78	78	66	91	140	137	13	13	13	13	14	14	14	14	14	14
1720	176	138	114	136	126	157	177	119	6	7	14	15	15	15	15	15	15	15	15	15
1730	59	77	90	30	46	2	57	23	49	42	15	15	15	15	15	15	15	15	15	15
1740	39	95	70	149	119	184	196	183	92	225	18	18	18	18	18	18	18	18	18	18
1750	79	125	85	69	86	47	95	65	123	140	19	19	19	19	19	19	19	19	19	19
1760	148	129	131	73	155	65	157	122	139	84	21	21	21	21	21	21	21	21	21	21
1770	89	117	105	54	88	103	89	94	22	58	21	21	21	21	21	21	21	21	21	21
1780	35	61	39	28	93	28	65	116	61	91	21	21	21	21	21	21	21	21	21	21
1790	17	120	133	186	144	156	154	114	97	130	21	21	21	21	21	21	21	21	21	21
1800	125	81	87	102	119	50	104	110	39	79	21	21	21	21	21	21	21	21	21	21
1810	43	105	92	4	74	66	140	116	10	9	21	21	21	21	21	21	21	21	21	21
1820	3	95	1	31	76	89	90	65	104	5	21	21	21	21	21	21	21	21	21	21
1830	92	111	58	130	117	159	139	180	239	215	21	21	21	21	21	21	21	21	21	21
1840	196	125	100	108	178	30	128	12	117	208	22	22	22	22	22	22	22	22	22	22
1850	178	80	185	112	74	127	137	49	144	113	22	22	22	22	22	22	22	22	22	22
1860	48	6	169	51	7	116	162	181	175	117	22	22	22	22	22	22	22	22	22	22
1870	69	17	37	44	99	66	25	91	75	20	22	22	22	22	22	22	22	22	22	22
1880	38	22	45	47	101	110	86	24	105	111	22	22	22	22	22	22	22	22	22	22
1890	158	125	134	116	32	133	35	112	93	6	22	22	22	22	22	22	22	22	22	22
1900	54	54	1	120	30	140	150	152	110	134	22	22	22	22	22	22	22	22	22	22
1910	115	151	138	149	163	178	185	159	81	147	22	22	22	22	22	22	22	22	22	22
1920	179	110	124	183	173	140	155	163	99	83	22	22	22	22	22	22	22	22	22	22
1930	71	94	169	156	112	111	66	179	128	85	22	22	22	22	22	22	22	22	22	22
1940	93	187	163	129	150	156	91	92	136	167	22	22	22	22	22	22	22	22	22	22
1950	110	58	163	40	48	139	14	110	91	14	22	22	22	22	22	22	22	22	22	22
1960	100	77	82	77	56	133	101	50	75	103	22	22	22	22	22	22	22	22	22	22
1970	88	101									22	22								

SERIAL CORRELATION = .403 STANDARD DEVIATION = .471 MEAN SENSITIVITY = .502 N = 405

SHOW LOW AZ USA J.S. DEAN & D.O. BOWDEN
232000 PIPO 56 3415N 10949W 2073M 377Y 1596:1972 24C SR: .56 SD: .55 MS: .52
A7: 25 SL:35 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

	TREE RING INDICES										NUMBER OF SAMPLES									
DATE	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
1596							87	51	42	79							1	1	1	1
1600	42	17	60	89	104	75	89	131	161	166	1	1	1	1	1	1	1	1	1	1
1610	189	151	154	75	135	122	88	146	203	191	1	1	1	1	1	1	1	1	1	1
1620	152	162	132	95	50	94	32	72	57	93	3	3	3	3	4	4	4	4	4	4
1630	122	116	40	80	70	86	124	133	104	109	5	5	5	5	5	5	5	5	6	6
1640	122	117	125	79	117	133	87	139	108	107	7	7	7	7	7	7	7	7	7	7
1650	113	96	110	64	35	70	84	71	74	90	7	7	7	9	10	11	11	11	11	11
1660	121	174	182	170	139	151	93	78	72	22	12	14	15	16	17	17	17	17	17	18
1670	2	48	84	98	110	123	82	92	56	91	19	19	20	20	20	20	20	20	20	20
1680	140	150	133	137	17	7	60	128	99	154	21	21	21	21	21	21	21	21	21	21
1690	227	183	223	178	186	207	107	82	49	146	21	21	21	21	21	21	21	21	21	21
1700	114	134	155	89	106	126	100	35	19	43	22	22	22	22	22	22	22	22	22	22
1710	71	85	118	103	131	81	40	73	117	104	22	22	22	22	22	22	22	22	22	22
1720	131	112	95	92	41	125	140	112	35	32	22	22	22	22	22	22	22	22	22	22
1730	40	31	72	29	51	6	51	62	73	89	24	24	24	24	24	24	24	24	24	24
1740	112	106	161	184	171	241	336	265	47	226	24	24	24	24	24	24	24	24	24	24
1750	130	75	10	27	70	24	38	37	86	98	24	24	24	24	24	24	24	24	24	24
1760	60	23	95	34	162	100	148	52	115	95	24	24	24	24	24	24	24	24	24	24
1770	98	129	119	8	82	59	86	43	10	97	24	24	24	24	24	24	24	24	24	24
1780	29	53	7	94	165	46	88	165	87	82	24	24	24	24	24	24	24	24	24	24
1790	84	134	145	246	79	117	77	78	69	84	24	24	24	24	24	24	24	24	24	24
1800	31	16	76	1	82	35	14	75	86	70	24	24	24	24	24	24	24	24	24	24
1810	71	45	141	109	173	204	217	177	71	6	24	24	24	24	24	24	24	24	24	24
1820	1	83	14	1	90	89	113	54	121	64	24	24	24	24	24	24	24	24	24	24
1830	84	65	69	114	87	148	115	136	221	272	24	24	24	24	24	24	24	24	24	24
1840	211	112	27	10	84	50	59	2	71	79	24	24	24	24	24	24	24	24	24	24
1850	130	113	119	138	86	108	90	42	140	53	24	24	24	24	24	24	24	24	24	24
1860	132	25	123	71	6	153	177	161	253	202	24	24	24	24	24	24	24	24	24	24
1870	112	70	91	54	77	96	79	65	101	80	24	24	24	24	24	24	24	24	24	24
1880	79	59	100	98	143	138	105	56	126	142	24	24	24	24	24	24	24	24	24	24
1890	169	155	161	55	56	87	152	163	118	33	24	24	24	24	24	24	24	24	24	24
1900	0	127	19	94	0	151	140	203	216	216	24	24	24	24	24	24	24	24	24	24
1910	137	239	173	91	164	192	160	185	145	206	24	24	24	24	24	24	24	24	24	24
1920	187	115	158	144	193	130	171	117	93	103	24	24	24	24	24	24	24	24	24	24
1930	103	91	164	186	98	107	121	152	100	72	24	24	24	24	24	24	24	24	24	24
1940	81	144	111	94	121	117	70	87	72	116	24	24	24	24	24	24	24	24	24	24
1950	49	21	121	78	70	14	41	52	61	33	24	24	24	24	24	24	24	24	24	24
1960	93	54	99	56	26	131	82	56	119	100	24	24	24	24	24	24	24	24	24	24
1970	72	10	105								24	24	8							

SERIAL CORRELATION = .555 STANDARD DEVIATION = .551 MEAN SENSITIVITY = .524 N = 377

OITCH CANYON NM USA DEAN, ROBINSON & BOWDEN
012000 PIPO 58 3700N 10749W 2073M 417Y 1555:1971 24C SR: .51 SD: .40 MS: .36
AZ:135 SL:15 NOTES: PU8. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

	TREE RING INOICES										NUMBER OF SAMPLES									
OATE	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
1555						104	104	137	91	66						1	1	1	1	1
1560	69	108	99	127	142	194	168	127	140	138	1	1	1	2	2	2	2	2	2	2
1570	96	128	97	57	66	66	46	82	64	33	3	3	3	3	3	3	3	3	3	3
1580	48	42	41	5	14	0	39	55	82	119	3	3	3	3	3	3	3	3	3	3
1590	50	121	71	79	114	114	177	126	123	149	3	3	3	3	3	3	3	3	3	3
1600	95	107	103	88	105	135	147	117	148	154	3	3	3	3	3	3	3	3	3	3
1610	170	139	146	106	126	98	100	117	147	128	4	4	4	4	4	4	4	4	4	4
1620	133	102	83	81	79	76	52	94	76	117	4	4	5	5	5	5	5	5	5	5
1630	105	94	62	103	103	100	151	106	105	133	5	5	5	5	5	5	6	6	6	6
1640	161	120	104	99	120	90	69	130	67	115	9	9	9	9	9	9	9	9	9	9
1650	143	119	133	127	76	122	134	113	70	81	10	10	10	10	10	10	10	10	10	10
1660	99	103	94	76	43	73	53	29	24	30	10	10	10	10	10	10	10	10	10	10
1670	43	81	120	130	147	107	45	84	69	87	10	10	10	10	10	11	11	11	11	11
1680	119	93	101	130	49	4	94	112	132	139	11	11	11	11	12	12	12	12	12	12
1690	130	149	246	176	145	163	84	164	146	171	12	12	12	12	12	12	12	12	12	12
1700	133	156	114	93	88	163	130	61	70	106	13	14	14	14	14	14	14	14	14	14
1710	129	110	111	100	94	82	88	88	132	123	14	14	14	14	14	14	14	14	14	14
1720	163	120	106	188	94	171	161	123	143	37	14	14	14	14	14	14	14	14	14	14
1730	93	104	141	101	119	8	75	54	94	63	15	15	15	15	15	15	15	15	15	15
1740	63	71	73	101	73	117	154	126	26	148	15	15	15	15	15	15	16	16	16	16
1750	79	59	37	45	115	39	43	71	78	62	16	16	16	16	16	16	16	16	16	16
1760	73	101	90	83	130	82	155	136	147	163	16	16	16	16	16	16	16	16	16	16
1770	177	169	166	95	145	121	84	99	89	85	16	16	16	16	16	16	16	16	16	16
1780	53	80	62	94	116	67	98	128	88	85	16	16	16	16	16	16	16	16	16	16
1790	58	124	90	138	61	86	89	55	91	149	16	16	16	16	16	16	16	16	16	16
1800	111	55	137	103	104	80	44	95	117	85	16	16	16	16	16	16	16	16	16	16
1810	118	124	132	124	146	149	176	104	36	36	17	17	17	17	17	17	17	18	18	18
1820	19	82	43	31	22	77	91	53	110	90	18	18	18	18	18	18	18	18	18	18
1830	160	126	154	135	111	153	87	68	105	114	19	19	19	20	20	20	20	20	20	20
1840	113	123	63	51	67	65	87	11	88	106	20	20	20	20	20	20	20	22	22	22
1850	97	41	143	128	134	112	104	94	96	81	22	23	23	24	24	24	24	24	24	24
1860	98	20	110	101	56	106	105	119	198	151	24	24	24	24	24	24	24	24	24	24
1870	88	55	63	76	92	105	37	129	95	70	24	24	24	24	24	24	24	24	24	24
1880	77	70	92	91	128	169	139	151	147	137	24	24	24	24	24	24	24	24	24	24
1890	166	137	111	98	52	69	40	123	106	59	23	23	23	23	23	23	23	23	23	23
1900	53	74	8	114	30	104	102	165	139	164	23	23	23	23	23	23	23	23	23	23
1910	140	203	124	90	203	167	175	130	102	145	23	23	23	23	23	23	23	23	23	23
1920	146	170	101	135	130	92	106	112	102	118	23	23	23	23	23	23	23	23	23	23
1930	101	90	134	86	64	108	72	101	121	63	23	23	23	23	23	23	23	23	23	23
1940	89	138	111	94	92	85	20	66	73	111	22	22	22	22	22	22	22	22	22	22
1950	42	18	74	37	73	44	29	96	73	41	22	22	22	22	22	22	22	22	22	22
1960	108	81	67	85	37	110	92	93	109	117	22	22	22	22	22	22	22	22	22	22
1970	91	106									22	22								

SERIAL CORRELATION = .510 STANDARO OEVIATION = .395 MEAN SENSITIVITY = .362 N = 417

EL MORRO I. NM USA J.S. DEAN & W. WOOLFENDEN
292099 PIPO 59 3502N 10821W 2225M 437Y 1536:1972 22C SR: .44 SD: .55 MS: .56
AZ: 45 SL:25 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

TREE RING INDICES

DATE	0	1	2	3	4	5	6	7	8	9
1536							140	165	103	126
1540	126	160	25	174	151	100	100	72	30	26
1550	113	175	128	160	85	121	174	209	135	151
1560	78	3	5	41	79	157	50	35	13	60
1570	112	115	204	40	10	49	30	77	93	0
1580	15	47	58	19	26	2	59	129	123	72
1590	7	26	1	7	76	102	74	111	202	78
1600	34	63	80	106	161	109	110	138	173	258
1610	213	207	133	69	133	108	162	199	127	129
1620	203	150	82	93	67	55	45	104	111	204
1630	179	98	11	195	187	89	193	94	81	169
1640	182	113	90	111	150	104	135	147	150	128
1650	157	220	255	109	88	139	141	65	80	55
1660	118	133	127	160	68	99	33	34	14	32
1670	40	20	95	92	18	118	49	73	31	116
1680	167	110	107	150	19	3	50	70	123	107
1690	146	127	192	177	165	175	62	108	58	175
1700	64	94	56	52	12	76	134	61	59	97
1710	136	154	151	105	105	62	14	56	97	102
1720	206	125	138	208	63	115	172	96	22	30
1730	96	115	164	47	122	10	98	75	123	20
1740	57	80	99	147	54	136	229	231	36	182
1750	79	82	57	53	109	32	48	64	111	144
1760	97	73	195	102	142	86	131	68	127	78
1770	134	159	107	60	110	53	63	30	57	51
1780	23	54	17	130	189	112	113	196	80	67
1790	52	132	171	195	188	126	57	57	81	124
1800	74	42	75	57	113	64	19	133	107	156
1810	71	101	64	92	109	174	222	206	152	68
1820	100	142	27	38	75	106	66	99	132	72
1830	120	87	83	180	84	93	87	96	137	223
1840	256	174	103	38	165	99	100	20	129	111
1850	118	88	109	82	125	137	111	131	156	84
1860	106	33	103	66	14	69	94	102	218	175
1870	130	46	38	45	82	90	81	127	69	40
1880	3	12	109	91	146	160	48	73	113	67
1890	11	87	75	48	23	112	30	59	79	8
1900	11	42	43	43	8	113	119	203	254	112
1910	140	191	166	106	165	178	171	156	102	200
1920	185	89	88	68	135	66	132	130	103	98
1930	170	70	130	56	90	149	163	134	106	92
1940	128	245	139	124	65	81	46	57	140	119
1950	78	7	76	50	49	34	47	25	86	9
1960	109	42	81	105	135	161	151	69	173	139
1970	120	14	136							

NUMBER OF SAMPLES

DATE	0	1	2	3	4	5	6	7	8	9
1536							1	1	1	2
1540	3	3	3	3	3	3	3	3	3	3
1550	3	3	3	3	3	3	3	3	3	3
1560	3	3	3	3	3	3	3	3	3	3
1570	3	3	3	3	3	3	3	3	3	3
1580	3	3	3	3	3	3	3	3	3	3
1590	3	3	3	3	3	3	3	3	3	3
1600	3	3	3	3	3	3	3	3	3	3
1610	3	3	3	3	3	3	3	3	3	4
1620	4	4	4	4	4	4	4	4	4	4
1630	4	4	4	4	5	5	5	5	5	5
1640	5	5	5	5	5	5	5	5	5	5
1650	5	5	5	5	5	5	5	5	5	5
1660	5	5	5	5	5	5	5	5	5	5
1670	5	5	5	5	5	5	5	5	5	5
1680	6	6	6	6	6	6	6	6	6	6
1690	6	6	7	8	8	8	8	8	8	8
1700	8	8	8	8	8	8	8	8	8	8
1710	9	9	9	9	9	9	9	9	10	10
1720	10	10	10	10	11	12	13	15	15	15
1730	16	16	16	16	16	16	16	16	16	16
1740	16	16	16	16	16	16	16	16	16	16
1750	17	17	17	17	18	19	19	19	19	19
1760	20	20	20	20	20	20	20	20	20	20
1770	20	20	20	20	20	20	20	20	20	20
1780	21	21	21	21	21	21	21	21	22	22
1790	22	22	22	22	22	22	22	22	22	22
1800	22	22	22	22	22	22	22	22	22	22
1810	22	22	22	22	22	22	22	22	22	22
1820	22	22	22	22	22	22	22	22	22	22
1830	22	22	22	22	22	22	22	22	22	22
1840	22	22	22	22	22	22	22	22	22	22
1850	22	22	22	22	22	22	22	22	22	22
1860	22	22	22	22	22	22	22	22	22	22
1870	22	22	22	22	22	22	22	22	22	22
1880	22	22	22	22	22	22	22	22	22	22
1890	22	22	22	22	22	22	22	22	22	22
1900	22	22	22	22	22	22	22	22	22	22
1910	22	22	22	22	22	22	22	22	22	22
1920	22	22	22	22	22	22	22	22	22	22
1930	22	22	22	22	22	22	22	22	22	22
1940	22	22	22	22	22	22	22	22	22	22
1950	22	22	22	22	22	22	22	22	22	22
1960	22	22	22	22	22	22	22	22	22	22
1970	22	22	22							

SERIAL CORRELATION = .440 STANDARD DEVIATION = .552 MEAN SENSITIVITY = .565 N = 437

TURKEY SPRINGS NM USA DEAN WOOLF'N ROB'SON, BURNS
272000 PIPO 60 3524N 10831W 2477M 378Y 1595:1972 26C SR: .45 SD: .51 MS: .53
AZ:295 SL:30 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

TREE RING INDICES

DATE	0	1	2	3	4	5	6	7	8	9
1595						91	119	44	24	87
1600	13	47	41	81	46	97	55	80	91	103
1610	123	105	122	95	135	155	92	248	208	105
1620	222	245	124	90	45	44	69	97	95	105
1630	113	77	43	103	87	107	93	60	66	105
1640	119	117	117	123	110	95	101	131	70	81
1650	104	183	195	93	78	128	160	83	56	69
1660	97	109	105	121	86	127	80	47	20	38
1670	23	63	95	120	107	113	63	75	39	85
1680	123	135	122	161	42	5	74	88	121	124
1690	125	89	154	144	123	138	63	130	109	196
1700	101	192	122	113	68	105	166	85	77	125
1710	184	144	158	86	122	86	44	71	123	92
1720	209	84	48	122	39	163	178	96	50	1
1730	61	75	118	40	65	1	20	45	75	24
1740	67	61	57	127	59	139	200	212	29	171
1750	118	49	31	16	109	53	36	59	93	121
1760	126	83	116	41	129	43	161	85	164	159
1770	132	214	208	52	109	116	96	37	65	59
1780	7	84	19	106	157	36	56	132	35	86
1790	109	139	157	247	146	118	92	50	68	91
1800	34	46	53	31	109	59	20	120	111	93
1810	58	90	73	75	103	179	221	155	52	29
1820	42	94	1	9	63	66	57	41	143	63
1830	94	72	54	102	103	131	154	145	223	259
1840	252	215	97	99	197	68	73	0	92	147
1850	138	73	142	116	77	131	115	88	159	85
1860	132	11	117	68	24	77	137	143	240	185
1870	124	46	41	58	111	101	67	114	64	28
1880	3	25	100	99	132	155	121	81	170	128
1890	119	144	84	58	35	104	54	64	75	17
1900	0	51	18	47	0	86	112	137	144	108
1910	119	191	118	77	136	188	265	178	164	207
1920	181	159	113	85	149	89	136	114	86	125
1930	127	74	128	94	65	85	77	128	107	89
1940	80	164	164	110	103	141	88	140	154	222
1950	97	9	127	71	84	37	23	94	86	40
1960	109	51	120	95	67	161	95	61	122	118
1970	98	34	122							

NUMBER OF SAMPLES

DATE	0	1	2	3	4	5	6	7	8	9
1595						1	1	1	1	1
1600	1	1	1	2	2	2	2	2	2	2
1610	2	2	2	2	2	2	2	2	2	2
1620	2	2	2	2	2	3	3	3	3	3
1630	4	4	4	4	4	4	4	4	4	6
1640	7	7	7	8	8	9	10	10	10	10
1650	10	11	11	11	11	12	12	12	12	12
1660	13	13	13	13	13	13	13	13	13	13
1670	15	15	15	16	16	17	17	18	18	18
1680	23	23	23	23	23	24	24	25	25	25
1690	26	26	26	26	26	26	26	26	26	26
1700	26	26	26	26	26	26	26	26	26	26
1710	26	26	26	26	26	26	26	26	26	26
1720	26	26	26	26	26	26	26	26	26	26
1730	26	26	26	26	26	26	26	26	26	26
1740	26	26	26	26	26	26	26	26	26	26
1750	26	26	26	26	26	26	26	26	26	26
1760	26	26	26	26	26	26	26	26	26	26
1770	26	26	26	26	26	26	26	26	26	26
1780	26	26	26	26	26	26	26	26	26	26
1790	26	26	26	26	26	26	26	26	26	26
1800	26	26	26	26	26	26	26	26	26	26
1810	26	26	26	26	26	26	26	26	26	26
1820	26	26	26	26	26	26	26	26	26	26
1830	26	26	26	26	26	26	26	26	26	26
1840	26	26	26	26	26	26	26	26	26	26
1850	26	26	26	26	26	26	26	26	26	25
1860	26	26	26	26	26	26	26	26	26	26
1870	26	26	26	26	26	26	26	26	26	26
1880	26	26	26	26	26	26	26	26	26	26
1890	26	26	26	26	26	26	26	26	26	26
1900	26	26	26	26	26	26	26	26	26	26
1910	26	26	26	26	26	26	26	26	26	26
1920	26	26	26	26	26	26	26	26	26	26
1930	26	26	26	26	26	26	26	26	26	26
1940	26	26	26	26	26	26	26	26	26	26
1950	26	26	26	26	26	26	26	26	26	26
1960	26	26	26	26	26	26	26	26	26	26
1970	26	20	20							

SERIAL CORRELATION = .451 STANDARD DEVIATION = .519 MEAN SENSITIVITY = .536 N = 378

SPANISH CREEK MT USA FERGUSON, DESPAIN & HOUSTON
317540 PSME 6H 4527N 11118W 1829M 349Y 1623:1971 20C SR: .33 SD: .36 MS: .36
AZ:999 SL:99 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

TREE RING INDICES

DATE	0	1	2	3	4	5	6	7	8	9
1623				83	100	125	79	34	103	121
1630	59	83	65	179	154	210	83	32	90	119
1640	206	133	124	203	174	67	36	99	113	175
1650	117	95	35	29	85	112	41	65	40	85
1660	135	90	86	99	92	34	126	111	140	127
1670	183	155	95	133	81	96	115	99	152	117
1680	154	85	48	140	139	139	116	111	87	99
1690	150	116	167	51	93	120	49	45	89	97
1700	107	79	113	112	57	68	102	96	47	87
1710	96	72	54	124	130	154	103	50	33	106
1720	85	52	117	95	135	145	103	109	77	109
1730	87	112	141	167	127	72	75	166	112	40
1740	102	124	128	118	59	75	110	67	39	113
1750	125	112	103	111	93	64	43	43	92	103
1760	72	121	125	67	80	102	73	105	164	96
1770	65	123	131	115	44	118	78	102	133	114
1780	93	96	87	60	96	101	101	135	138	163
1790	133	61	82	53	68	99	92	149	112	121
1800	33	80	105	120	149	57	76	117	67	59
1810	118	133	68	119	143	63	51	83	47	65
1820	79	95	69	69	94	80	115	73	100	131
1830	92	86	129	192	65	136	94	126	145	151
1840	81	69	79	84	93	65	61	47	59	97
1850	69	102	61	133	139	77	106	86	135	121
1860	114	54	102	21	63	55	106	94	81	105
1870	120	86	82	109	55	77	100	96	111	127
1880	103	39	104	123	68	101	112	146	184	67
1890	80	148	173	122	131	117	108	133	170	147
1900	105	119	86	142	127	115	113	180	154	124
1910	136	158	145	86	160	166	185	154	150	69
1920	104	146	104	118	134	181	104	143	156	145
1930	39	127	104	84	34	76	60	36	72	62
1940	85	64	114	47	87	97	78	111	94	83
1950	112	47	102	89	50	78	61	70	58	75
1960	59	34	103	119	63	110	86	82	96	127
1970	141	86								

NUMBER OF SAMPLES

DATE	0	1	2	3	4	5	6	7	8	9
1623				1	1	1	1	1	1	1
1630	1	1	1	1	1	1	1	1	1	1
1640	1	1	1	1	1	1	1	1	2	2
1650	2	2	2	2	2	2	2	2	2	2
1660	2	2	2	2	2	2	2	2	2	2
1670	2	2	3	3	3	3	3	3	4	4
1680	4	4	4	4	5	5	5	5	5	5
1690	5	5	6	7	7	7	7	7	8	8
1700	8	9	9	9	10	10	11	11	11	11
1710	11	11	11	11	11	11	11	11	11	12
1720	12	12	12	12	12	12	12	12	12	12
1730	12	13	13	13	13	13	14	14	14	14
1740	15	15	15	15	15	15	15	16	16	16
1750	17	17	17	17	17	17	17	17	17	17
1760	17	17	17	17	17	17	17	17	17	18
1770	18	18	18	18	18	18	18	18	18	18
1780	18	18	18	18	18	18	18	18	18	18
1790	18	18	18	18	18	18	18	18	18	18
1800	18	18	18	18	18	18	18	18	18	18
1810	18	18	18	18	18	18	18	18	18	18
1820	18	18	18	18	18	18	18	18	18	18
1830	18	18	18	18	18	18	18	18	18	18
1840	18	18	18	18	18	18	18	18	19	19
1850	19	19	19	19	19	19	19	19	19	19
1860	19	19	19	19	19	19	19	19	20	20
1870	20	20	20	20	20	20	20	20	20	20
1880	20	20	20	20	20	20	20	20	20	20
1890	20	20	20	20	20	20	20	20	20	20
1900	20	20	20	20	20	20	20	20	20	20
1910	20	20	20	20	20	20	20	20	20	20
1920	20	20	20	20	20	20	20	20	20	20
1930	20	20	20	20	20	20	20	20	20	20
1940	20	20	20	20	20	20	20	20	20	20
1950	20	20	20	20	20	20	20	20	20	20
1960	20	20	20	20	20	20	20	20	20	20
1970	20	20								

SERIAL CORRELATION = .334 STANDARD DEVIATION = .363 MEAN SENSITIVITY = .365 N = 349

PEDRO MOUNTAINS 'A'   WY   USA   H.A. STOKES & T.P. HARLAN
106640 PIPO 69 4222N 10651W 2188M 355Y 1610:1964 14C SR: .38 SD: .25 MS: .24
AZ:999 SL:99 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

TREE RING INDICES

DATE	0	1	2	3	4	5	6	7	8	9
1610	78	82	75	91	116	101	137	146	113	97
1620	157	110	126	69	66	85	80	106	69	78
1630	87	133	100	109	123	77	110	101	64	96
1640	66	102	108	126	95	104	81	71	92	62
1650	79	83	71	103	98	104	148	115	139	114
1660	112	121	122	117	112	84	72	98	83	106
1670	109	71	81	135	118	109	125	107	98	88
1680	90	77	84	100	149	126	129	104	96	110
1690	144	126	99	86	122	110	67	79	67	81
1700	115	90	103	98	68	113	106	109	82	62
1710	73	87	52	70	101	101	100	68	80	89
1720	128	118	150	166	143	123	131	118	86	131
1730	100	96	99	100	130	102	66	96	100	89
1740	124	106	71	74	72	89	95	90	107	102
1750	87	123	112	106	101	109	85	78	70	110
1760	61	147	73	94	141	90	102	157	122	117
1770	115	87	90	96	96	105	110	126	103	99
1780	136	94	101	123	121	94	69	103	86	109
1790	96	96	145	102	143	132	111	31	21	26
1800	37	49	70	85	75	76	82	63	94	60
1810	70	117	72	76	111	85	118	89	104	95
1820	95	96	100	73	58	90	75	77	96	102
1830	112	102	98	146	122	136	139	128	129	152
1840	117	78	82	118	122	63	90	111	69	130
1850	123	109	121	126	79	117	77	88	127	116
1860	126	50	133	119	86	82	118	95	77	122
1870	119	95	114	77	106	91	111	83	124	100
1880	91	85	83	81	62	106	95	58	110	122
1890	86	118	102	73	95	114	87	89	115	133
1900	94	138	158	127	154	120	120	104	134	99
1910	115	124	118	114	114	142	95	72	158	84
1920	61	120	72	76	57	75	101	100	119	70
1930	106	120	78	47	47	52	70	96	77	54
1940	82	120	93	89	104	120	124	146	101	105
1950	109	110	106	95	116	123	89	109	102	110
1960	126	104	155	137	85					

NUMBER OF SAMPLES

DATE	0	1	2	3	4	5	6	7	8	9
1610	1	1	1	1	1	1	1	1	1	1
1620	1	1	1	1	1	1	1	1	1	1
1630	1	1	1	1	1	1	1	1	1	1
1640	1	1	1	1	1	1	1	1	1	1
1650	1	1	1	1	1	1	1	1	1	1
1660	2	2	2	2	2	2	2	2	2	2
1670	2	2	2	2	2	2	2	2	2	2
1680	2	2	2	2	2	2	3	3	3	3
1690	3	3	4	4	4	4	4	4	4	4
1700	4	4	4	4	4	4	4	4	5	5
1710	5	5	5	5	5	5	5	5	5	5
1720	5	5	5	5	5	5	5	5	5	5
1730	5	6	6	6	6	7	7	7	7	7
1740	8	8	8	8	8	8	8	8	8	8
1750	8	8	8	8	8	8	8	8	8	8
1760	8	8	8	8	8	8	8	8	9	9
1770	9	9	9	9	9	9	9	9	9	9
1780	9	9	9	9	9	9	10	10	10	11
1790	12	12	12	12	12	12	12	12	12	12
1800	12	12	12	12	12	12	12	12	12	12
1810	12	12	12	12	12	12	12	12	12	12
1820	12	12	12	12	12	12	12	12	12	12
1830	12	12	12	12	12	12	12	12	12	12
1840	12	12	12	12	12	12	12	12	12	12
1850	12	12	12	12	12	12	12	12	12	12
1860	14	14	14	14	14	14	14	14	14	14
1870	14	14	14	14	14	14	14	14	14	14
1880	14	14	14	14	14	14	14	14	14	14
1890	14	14	14	14	14	14	14	14	14	14
1900	14	14	14	14	14	14	14	14	14	14
1910	14	14	14	14	14	14	14	14	14	14
1920	14	14	14	14	14	14	14	14	14	14
1930	14	14	14	14	14	14	14	14	14	14
1940	14	14	14	14	14	14	14	14	14	14
1950	14	14	14	14	14	14	14	14	14	14
1960	14	14	14	14	13					

SERIAL CORRELATION = .383 STANDARD DEVIATION = .247 MEAN SENSITIVITY = .223 N = 355

BIG THOMPSON CO USA H.C. FRITTS & R.L. HOLMES
492000 PSME 70 4025N 10517W [illegible]890M 265Y 1700:1964 20C SR: .2[illegible] SD: .40 MS: .43
AZ:360 SL:45 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

	TREE RING INDICES										NUMBER OF SAMPLES									
OATE	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
1700	124	59	147	74	72	122	153	115	83	32	1	1	1	1	1	1	1	1	1	1
1710	142	72	110	91	125	93	121	74	75	122	3	3	3	3	3	3	3	3	3	3
1720	160	125	134	104	61	90	105	114	112	84	6	6	6	6	6	6	6	6	6	6
1730	43	125	87	107	174	70	77	122	120	90	9	9	9	9	9	9	9	9	9	9
1740	49	94	46	87	30	77	130	145	91	137	12	12	12	12	12	12	12	12	12	12
1750	56	134	119	83	62	81	85	51	83	75	15	15	15	15	15	15	15	15	15	15
1760	69	125	122	81	82	75	132	99	187	112	15	15	15	15	15	15	15	15	15	15
1770	63	111	69	98	98	89	137	158	166	166	15	15	15	15	15	15	15	15	15	15
1780	44	89	91	113	112	146	91	205	88	48	15	15	15	15	15	15	15	15	15	15
1790	135	100	166	151	161	85	67	73	67	101	16	16	16	16	16	16	16	16	16	16
1800	100	68	63	129	76	17	112	85	71	54	17	17	17	17	17	17	17	17	17	17
1810	101	59	80	70	117	123	102	129	63	61	17	17	17	17	17	17	17	17	17	17
1820	15	91	119	89	53	108	59	125	162	139	19	19	19	19	19	19	19	19	19	19
1830	107	77	99	114	111	141	177	190	207	267	20	20	20	20	20	20	20	20	20	20
1840	77	187	49	172	179	94	71	43	44	99	20	20	20	20	20	20	20	20	20	20
1850	102	43	89	101	78	40	79	102	127	112	20	20	20	20	20	20	20	20	20	20
1860	90	27	87	36	90	97	135	124	89	139	20	20	20	20	20	20	20	20	20	20
1870	63	34	120	88	41	30	113	95	159	53	20	20	20	20	20	20	20	20	20	20
1880	1	76	70	119	107	110	82	24	63	78	20	20	20	20	20	20	20	20	20	20
1890	106	83	101	81	45	90	72	82	86	61	20	20	20	20	20	20	20	20	20	20
1900	86	90	65	100	99	147	122	147	78	153	20	20	20	20	20	20	20	20	20	20
1910	92	74	148	143	171	149	137	131	130	85	20	20	20	20	20	20	20	20	20	20
1920	157	169	131	142	160	15	165	158	157	90	20	20	20	20	20	20	20	20	20	20
1930	123	134	56	94	80	70	106	59	70	96	20	20	20	20	20	20	20	20	20	20
1940	29	112	124	148	84	107	44	170	153	127	20	20	20	20	20	20	20	20	20	20
1950	113	124	152	91	3	35	62	92	118	118	20	20	20	20	20	20	20	20	20	20
1960	89	113	138	48	53						20	20	20	20	20					

SERIAL CORRELATION = .252 STANOARO OEVIATION = .404 MEAN SENSITIVITY = .434 N = 265

UINTA MOUNTAINS 'C' UT USA STOCKTON, HARSHA & JACOBY
279540 PSME 72 4034N 10957W 2286M 337Y 1635:1971 18C SR: .55 SO: .40 MS: .34
AZ:315 SL:45 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

	TREE RING INOICES										NUMBER OF SAMPLES									
OATE	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
1635						100	86	43	48	74						1	1	1	1	1
1640	93	106	94	70	80	42	80	66	60	97	1	1	1	2	2	2	2	2	2	2
1650	74	94	56	35	42	86	108	91	74	75	2	2	2	2	2	2	2	2	2	2
1660	49	42	69	95	87	51	65	44	47	80	2	2	2	2	2	2	2	2	2	2
1670	32	88	94	144	159	113	143	111	103	95	3	3	3	3	3	3	3	3	3	3
1680	163	114	98	185	160	75	36	148	153	96	3	3	3	3	3	3	3	3	3	3
1690	101	150	145	121	116	78	104	76	47	72	3	3	3	3	3	3	3	3	3	3
1700	100	132	204	130	130	150	81	42	47	87	3	3	3	3	3	3	3	3	3	3
1710	82	106	127	130	92	107	143	95	114	133	4	4	4	4	4	4	4	4	4	4
1720	156	127	72	131	112	129	150	145	133	65	4	4	4	4	4	4	4	4	4	4
1730	133	188	131	97	157	48	72	95	110	93	4	4	4	4	[illegible]	5	5	5	5	5
1740	72	78	77	85	77	91	117	192	85	134	5	5	5	5	5	6	6	6	6	6
1750	133	85	55	128	106	61	26	60	100	96	6	6	6	6	6	6	6	6	6	6
1760	85	115	107	69	112	65	111	128	122	140	6	6	6	6	6	6	6	6	6	6
1770	104	142	79	44	73	56	64	85	34	72	6	6	6	6	6	6	6	7	7	7
1780	64	68	11	60	66	83	52	69	57	52	7	7	7	8	9	9	9	9	9	9
1790	104	130	204	163	113	62	87	163	62	119	9	9	9	9	9	9	9	9	9	9
1800	55	80	99	110	86	60	67	73	43	36	9	9	9	9	9	9	9	9	9	9
1810	117	134	158	59	59	111	171	159	110	136	10	10	10	10	10	10	10	10	10	10
1820	105	134	63	68	40	78	86	92	125	106	10	10	10	10	10	10	10	10	10	10
1830	110	101	125	87	105	106	76	131	151	156	11	11	11	11	12	13	14	14	14	14
1840	181	169	92	145	116	25	87	66	78	99	14	14	14	14	14	14	14	15	15	15
1850	101	113	106	159	164	127	89	57	69	82	15	15	15	15	15	15	15	15	15	15
1860	60	50	101	81	58	75	131	142	156	137	15	17	17	18	18	18	18	18	18	18
1870	148	47	94	60	59	76	113	96	98	60	18	18	18	18	18	18	18	18	18	18
1880	54	73	42	38	69	114	108	88	128	75	18	18	18	18	18	18	18	18	18	18
1890	103	114	117	62	55	130	102	115	170	76	18	18	18	18	18	18	18	18	18	18
1900	99	103	58	107	81	65	107	250	215	196	18	18	18	18	18	18	18	18	18	18
1910	171	176	151	130	193	185	145	170	158	102	18	18	18	18	18	18	18	18	18	18
1920	120	150	136	127	82	41	92	106	155	164	18	18	18	18	18	18	18	18	18	18
1930	172	78	82	59	17	45	45	95	107	97	18	18	18	18	18	18	18	18	18	18
1940	112	141	162	135	148	103	30	124	97	105	18	18	18	18	18	18	18	18	18	18
1950	116	61	83	49	52	49	43	53	69	17	18	18	18	18	18	18	18	18	18	18
1960	50	37	60	57	50	81	97	83	89	111	18	18	18	18	18	18	18	18	18	18
1970	83	88									18	18								

SERIAL CORRELATION = .549 STANOARD OEVIATION = .403 MEAN SENSITIVITY = .335 N = 337

MT. TRUMBULL 'A' & TUWEEP AZ USA M.A. STOKES & T.P. HARLAN
521629 PIEO 75 3628N 11308W 1798M 345Y 1620:1964 16C SR: .41 SD: .37 MS: .35
AZ:999 SL:99 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

TREE RING INDICES

DATE	0	1	2	3	4	5	6	7	8	9
1620	116	61	36	36	62	38	67	45	43	52
1630	29	24	46	55	77	45	27	37	70	100
1640	122	122	102	120	74	81	0	82	104	208
1650	135	203	100	102	54	93	119	128	129	137
1660	148	141	149	126	137	110	149	132	121	74
1670	67	74	123	128	145	101	78	123	106	129
1680	174	113	113	139	55	101	68	146	148	161
1690	110	98	120	99	122	155	123	136	75	141
1700	82	102	100	48	96	138	117	70	74	100
1710	126	127	127	110	93	80	68	106	137	124
1720	132	69	64	104	121	135	162	121	118	87
1730	131	123	139	65	160	40	55	68	131	53
1740	60	90	61	107	116	143	150	147	83	136
1750	84	81	69	81	72	68	85	72	116	95
1760	122	93	107	105	132	90	142	144	169	137
1770	122	168	83	43	67	113	61	105	47	95
1780	57	83	74	93	152	76	104	137	72	103
1790	101	127	109	141	101	99	88	99	81	111
1800	39	65	107	53	104	36	70	66	42	42
1810	76	104	81	49	47	97	151	110	114	128
1820	59	142	17	57	93	129	130	99	156	64
1830	103	109	135	148	107	132	112	127	179	181
1840	164	107	92	131	135	72	128	37	138	151
1850	155	87	135	150	125	102	45	52	84	60
1860	48	37	89	59	32	81	108	133	147	140
1870	104	70	74	78	95	104	109	91	83	79
1880	54	50	62	91	125	123	109	93	110	120
1890	126	115	106	94	84	82	21	104	96	2
1900	45	85	19	103	29	110	148	147	126	129
1910	128	148	148	120	155	145	153	146	98	155
1920	146	93	158	115	59	101	116	86	129	57
1930	115	109	142	103	67	121	79	162	152	88
1940	120	121	110	109	108	106	85	93	92	129
1950	72	31	131	68	100	70	47	102	102	56
1960	92	79	91	50	111					

NUMBER OF SAMPLES

DATE	0	1	2	3	4	5	6	7	8	9
1620	1	1	1	1	1	1	1	1	1	1
1630	1	1	1	1	1	1	1	1	1	1
1640	1	1	1	1	1	1	1	1	1	1
1650	1	1	1	1	1	1	1	1	1	1
1660	1	1	1	1	1	1	1	1	1	1
1670	1	1	1	1	1	1	1	1	1	1
1680	1	1	1	1	1	1	1	1	1	1
1690	2	2	2	2	2	2	2	2	2	2
1700	4	4	4	4	4	4	4	4	4	4
1710	4	4	4	4	4	4	4	4	5	5
1720	6	6	6	6	6	6	6	6	6	6
1730	7	7	7	7	7	7	7	7	7	7
1740	8	8	8	8	8	8	8	8	8	8
1750	9	9	9	9	9	9	9	9	9	9
1760	9	9	9	9	9	9	9	9	9	9
1770	9	9	9	9	9	9	9	9	9	9
1780	10	10	10	10	11	11	11	11	11	11
1790	11	11	11	11	11	11	11	11	11	11
1800	12	12	12	12	13	13	13	13	13	13
1810	13	13	13	13	13	13	13	13	13	13
1820	13	14	14	14	14	14	14	14	14	14
1830	14	14	14	14	14	14	14	14	14	14
1840	14	14	14	14	14	14	14	14	14	14
1850	14	14	14	14	14	14	14	14	14	14
1860	16	16	16	16	16	16	16	16	16	16
1870	16	16	16	16	16	16	16	16	16	16
1880	16	16	16	16	16	16	16	16	16	16
1890	16	16	16	16	16	16	16	16	16	16
1900	16	16	16	16	16	16	16	16	16	16
1910	16	16	16	16	16	16	16	16	16	16
1920	16	16	16	16	16	16	16	16	16	16
1930	16	16	16	16	16	16	16	16	16	16
1940	16	16	16	16	16	16	16	16	16	16
1950	16	16	16	16	16	16	16	16	16	16
1960	16	15	15	14	11					

SERIAL CORRELATION = .412 STANDARD DEVIATION = .366 MEAN SENSITIVITY = .353 N = 345

SPIOER ROCK AZ USA DEAN ROBINSON BOWDEN. BURNS

083099 PIED 76 3606N 10921W 1890M 371Y 1601:1971 34C SR: .30 SD: .40 MS: .44
AZ:360 SL:30 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

	TREE RING INDICES										NUMBER OF SAMPLES									
OATE	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
1601		91	62	57	46	59	76	75	77	134		1	1	1	1	1	1	1	1	2
1610	109	116	101	72	117	109	114	139	138	105	2	2	2	2	2	2	2	2	2	3
1620	117	159	81	68	41	89	58	123	100	124	3	3	4	4	4	4	4	4	4	4
1630	131	84	79	106	124	99	90	[illegible]	93	93	4	4	4	5	5	5	5	5	6	6
1640	101	108	105	101	110	115	95	119	75	89	8	8	8	8	8	9	11	11	11	11
1650	125	134	109	73	22	85	134	76	71	114	11	11	11	11	11	11	11	11	11	11
1660	141	122	104	111	76	117	87	76	51	57	11	12	12	12	12	12	12	12	12	12
1670	19	81	144	174	156	120	80	124	148	55	15	15	15	15	15	15	15	15	16	16
1680	130	146	116	146	86	26	87	120	[illegible]	166	17	17	17	17	18	18	18	18	19	19
1690	155	152	150	166	105	112	70	91	[illegible]	92	19	20	20	20	20	20	20	20	20	20
1700	15	113	57	90	72	103	107	60	[illegible]	70	20	20	20	20	20	20	20	20	21	21
1710	108	77	79	49	104	86	39	56	108	107	21	21	21	21	22	22	22	22	22	22
1720	176	117	106	116	85	120	153	118	35	17	22	22	22	22	22	22	23	23	23	24
1730	76	118	127	117	100	29	85	72	96	47	24	24	24	24	24	24	24	24	24	24
1740	56	102	82	174	108	168	167	145	38	122	25	25	25	25	25	25	25	25	25	25
1750	66	73	53	18	67	35	81	97	117	136	26	26	26	26	26	26	26	26	26	27
1760	149	84	106	88	152	77	149	126	150	103	27	27	27	27	28	29	29	29	30	30
1770	89	107	142	68	95	97	78	66	58	83	31	31	31	31	31	31	31	31	31	31
1780	55	93	76	115	183	90	112	153	50	79	32	32	32	32	32	32	32	32	32	32
1790	49	142	132	157	114	80	131	121	99	129	32	33	33	33	33	33	33	33	33	33
1600	117	62	115	80	127	59	49	145	80	116	33	33	33	33	33	33	34	34	34	34
1810	92	94	99	46	106	109	157	137	47	43	34	34	34	34	34	34	34	34	34	34
1820	16	122	14	63	96	149	176	120	182	58	34	34	34	34	34	34	34	34	34	34
1830	131	96	44	162	72	151	120	171	171	183	34	34	34	34	34	34	34	34	34	34
1840	142	91	66	97	144	93	97	22	96	201	34	34	34	34	34	34	34	34	34	34
1850	188	41	150	136	52	149	156	65	169	99	34	34	34	34	34	34	34	34	34	34
1860	48	7	117	71	66	150	179	189	212	140	34	34	34	34	34	34	34	34	34	34
1870	100	70	35	39	111	61	79	96	94	95	34	34	34	34	34	34	34	34	34	34
1880	72	66	77	44	76	95	50	52	103	88	34	34	34	34	34	34	34	34	34	34
1890	98	134	130	50	40	79	29	98	81	37	34	34	34	34	34	34	34	34	34	34
1900	39	68	2	127	32	155	140	145	101	109	34	34	34	34	34	34	34	34	34	34
1910	82	156	104	97	144	168	159	127	131	171	34	34	34	34	34	34	34	34	34	34
1920	179	135	129	98	145	96	128	114	45	95	34	34	34	34	34	34	34	34	34	34
1930	71	79	108	57	51	84	71	154	122	99	34	34	34	34	34	34	34	34	34	34
1940	89	170	141	95	139	120	43	74	146	166	34	34	34	34	34	34	34	34	34	34
1950	37	6	161	53	45	95	66	118	80	9	34	34	34	34	34	34	34	34	34	34
1960	121	86	115	136	73	153	79	11	76	101	34	34	34	34	34	34	34	34	34	34
1970	89	88									34	26								

SERIAL CORRELATION = .295 STANOARO DEVIATION = .405 MEAN SENSITIVITY = .439 N = 371

MEDICINE VALLEY AZ USA J.S. DEAN & D.O. BOWDEN
222000 PIPO 77 3524N 11135W 2190M 294Y 1679:1972 20C SR: .38 SD: .43 MS: .44
AZ: 20 SL:33 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

	TREE RING INOICES										NUMBER OF SAMRLES									
OATE	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
1679										35										1
1680	138	113	85	95	51	47	77	81	115	125	1	1	1	2	2	2	2	2	2	2
1690	90	123	148	104	149	125	82	101	141	152	2	2	2	2	2	2	2	2	2	2
1700	111	126	96	69	93	110	82	114	61	68	2	3	3	4	4	4	4	4	4	4
1710	106	87	84	105	90	112	47	100	102	167	4	4	5	5	5	5	5	6	6	6
1720	192	131	95	119	80	116	179	94	98	40	6	6	6	6	6	6	6	6	6	6
1730	71	93	90	57	81	27	116	51	113	53	6	6	6	6	6	6	6	6	6	6
1740	108	109	58	164	125	170	184	145	33	137	6	6	6	7	7	8	8	8	8	8
1750	76	114	27	82	122	40	137	129	159	152	8	8	8	8	8	8	8	8	9	11
1760	150	58	98	44	100	88	127	122	125	99	12	13	13	13	13	13	13	13	13	13
1770	104	125	82	32	65	65	78	79	70	79	15	16	16	16	16	16	16	16	16	16
1780	58	99	84	147	156	50	56	114	76	81	16	16	16	16	16	16	16	16	16	16
1790	95	115	136	211	127	166	167	147	74	151	16	16	16	16	16	16	16	16	16	16
1800	73	65	81	52	102	46	80	94	96	108	20	20	20	20	20	20	20	20	20	20
1810	119	127	115	16	66	92	132	98	50	53	20	20	20	20	20	20	20	20	20	20
1820	56	112	46	91	115	138	158	126	167	67	20	20	20	20	20	20	20	20	20	20
1830	116	150	113	166	89	145	94	112	135	176	20	20	20	20	20	20	20	20	20	20
1840	141	111	46	83	132	35	52	3	83	95	20	20	20	20	20	20	20	20	20	20
1850	136	89	139	98	101	113	81	4	103	51	20	20	20	20	20	20	20	20	20	20
1860	81	90	120	51	18	85	130	121	174	114	20	20	20	20	20	20	20	20	20	20
1870	107	38	93	55	87	75	67	70	66	12	20	20	20	20	20	20	20	20	20	20
1880	14	24	82	80	119	121	96	77	124	149	20	20	20	20	20	20	20	20	20	20
1890	161	176	137	69	110	101	32	91	104	30	20	20	20	20	20	20	20	20	20	20
1900	45	56	7	99	6	118	137	216	220	209	20	20	20	20	20	20	20	20	20	20
1910	172	217	185	53	114	158	136	171	169	166	20	20	20	20	20	20	20	20	20	20
1920	160	113	167	117	152	93	133	74	103	105	20	20	20	20	20	20	20	20	20	20
1930	91	75	133	130	77	90	42	82	64	58	20	20	20	20	20	20	20	20	20	20
1940	37	125	111	42	107	91	96	62	98	142	20	20	20	20	20	20	20	20	20	20
1950	58	7	115	67	38	89	97	76	82	89	20	20	20	20	20	20	20	20	20	20
1960	93	140	132	40	117	141	140	145	134	133	20	20	20	20	20	20	20	20	20	20
1970	180	31	152								20	20	12							

SERIAL CORRELATION = .382 STANOARO OEVIATION = .428 MEAN SENSITIVITY = .445 N = 294

S. P. MOUNTAIN I. AZ OSA J.S. OEAN & D.O. BOWDEN
263099 PIED 78 3535N 11139W 2042M 284Y 1689:1972 20C SR: .42 SD: .46 MS: .46
AZ:270 SL:10 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

	TREE RING INOICES										NUMBER OF SAMPLES									
OATE	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
1689										141										1
1690	81	117	93	117	66	77	85	77	144	153	1	1	1	2	2	2	2	2	2	2
1700	65	181	103	44	63	115	100	39	62	42	2	2	2	2	2	2	2	2	3	3
1710	106	77	107	95	99	73	75	177	223	171	3	3	3	3	3	3	3	4	5	7
1720	246	170	123	106	74	117	170	125	43	9	7	7	7	7	7	7	7	8	9	9
1730	76	82	77	49	73	43	122	51	91	38	9	9	9	9	9	9	9	11	11	11
1740	40	78	20	149	145	183	177	152	18	148	11	11	11	11	11	11	11	11	11	12
1750	[illegible]	66	63	80	119	65	118	135	159	150	12	12	12	12	12	12	12	12	13	14
1760	156	96	108	98	162	108	168	116	165	120	15	15	15	15	15	15	15	15	15	15
1770	115	110	98	68	124	124	138	117	31	73	15	15	16	16	16	16	16	16	16	16
1780	43	90	114	166	154	66	70	161	81	75	16	16	16	16	16	16	16	16	16	16
1790	44	142	115	167	112	108	84	81	22	84	16	16	16	16	16	16	16	16	17	17
1800	32	57	59	42	78	59	41	67	64	74	17	17	17	17	17	18	18	18	18	18
1810	63	89	91	2	21	47	104	113	57	57	18	18	18	18	18	18	18	18	18	18
1820	36	94	64	69	131	137	146	116	169	83	19	19	19	19	19	19	19	19	19	19
1830	99	150	51	130	94	115	72	101	133	165	19	19	19	19	19	19	19	19	19	20
1840	160	137	56	72	153	102	113	48	162	188	20	20	20	20	20	20	20	20	20	20
1850	186	124	142	140	86	147	63	5	101	40	20	20	20	20	20	20	20	20	20	20
1860	61	75	141	57	43	103	151	146	156	154	20	20	20	20	20	20	20	20	20	20
1870	164	58	67	53	92	62	69	38	67	20	20	20	20	20	20	20	20	20	20	20
1880	30	29	106	99	164	114	124	78	144	154	20	20	20	20	20	20	20	20	20	20
1890	205	186	178	104	164	171	104	87	99	35	20	20	20	20	20	20	20	20	20	20
1900	58	83	21	68	11	121	133	107	134	123	20	20	20	20	20	20	20	20	20	20
1910	109	146	121	64	112	141	122	157	148	168	20	20	20	20	20	20	20	20	20	20
1920	174	123	112	152	197	80	106	135	170	115	20	20	20	20	20	20	20	20	20	20
1930	142	127	141	80	137	90	42	129	119	31	20	20	20	20	20	20	20	20	20	20
1940	37	127	92	16	123	107	98	20	100	120	20	20	20	20	20	20	20	20	20	20
1950	51	19	117	62	50	56	60	63	73	100	20	20	20	20	20	20	20	20	20	20
1960	76	108	99	28	62	85	118	97	106	127	20	20	20	20	20	20	20	20	20	20
1970	128	15	125								20	20	18							

SERIAL CORRELATION = .417 STANOARO UEVIATION = .456 MEAN SENSITIVITY = .461 N = 284

GRASSHOPPER AZ USA J.S. OEAN & R.L. WARREN
022000 PIPO 79 3404N 11035W 1798M 330Y 1642:1971 28C SR: .50 SD: .47 MS: .48
A7:360 SL: 5 NOTES: PUB. IN "TREE-RING CHRON. FOR OENOROCLIMATIC ANALYSIS" 1976

OATE	TREE RING INOICES 0	1	2	3	4	5	6	7	8	9	NUMBER OF SAMPLES 0	1	2	3	4	5	6	7	8	9
1642			171	111	143	167	151	169	59	97			1	2	2	2	2	2	2	2
1650	112	160	127	83	28	50	70	36	44	45	2	2	2	2	2	2	2	2	2	2
1660	62	61	77	72	56	61	72	27	30	15	2	2	2	2	2	2	2	2	2	2
1670	0	58	80	72	46	49	47	88	84	150	2	2	2	2	2	2	2	2	2	2
1680	203	177	156	142	57	13	65	121	116	124	3	3	3	3	3	3	3	3	3	3
1690	119	105	162	141	168	152	59	79	86	160	3	3	3	3	3	3	4	4	4	4
1700	117	139	158	122	129	170	156	59	72	98	4	4	5	5	5	5	5	5	5	5
1710	171	106	80	94	146	89	34	88	134	108	5	5	5	5	6	6	6	6	6	6
1720	129	80	60	119	33	109	152	122	75	31	6	6	6	6	6	6	6	6	6	6
1730	81	51	110	51	122	11	34	95	134	64	6	6	6	6	6	6	6	6	6	6
1740	137	136	99	127	123	164	241	241	68	267	7	7	7	7	7	7	7	7	7	7
1750	196	96	11	32	43	25	30	15	39	56	7	7	7	7	7	7	7	7	7	8
1760	69	31	87	49	138	80	148	110	153	109	10	10	10	10	10	11	12	12	12	12
1770	120	165	166	52	101	110	140	88	45	81	13	13	13	13	13	13	13	14	14	14
1780	43	58	18	86	141	52	91	135	44	97	14	14	14	14	14	14	14	14	14	14
1790	67	121	156	201	116	154	117	66	81	102	14	14	14	14	14	14	14	14	14	14
1800	66	40	69	19	71	63	82	100	126	129	14	14	14	14	14	14	14	14	14	14
1810	109	120	115	87	122	138	167	103	57	34	14	14	14	14	14	14	14	14	14	14
1820	3	82	23	5	98	135	146	110	173	82	14	14	14	14	14	14	14	14	14	14
1830	121	109	138	148	142	122	135	95	168	179	14	14	14	14	14	14	14	15	15	15
1840	129	55	81	84	153	42	75	4	79	126	15	15	15	15	15	15	15	15	15	15
1850	117	99	174	186	104	154	133	69	115	68	15	16	16	16	16	16	17	19	19	20
1860	114	58	124	71	16	120	129	139	207	182	22	22	22	23	23	23	23	25	26	27
1870	110	28	80	54	90	127	92	85	110	101	28	28	28	28	28	28	28	28	28	28
1880	84	83	100	112	151	168	130	60	104	94	28	28	28	28	28	28	28	28	28	28
1890	116	95	85	44	23	71	79	94	106	80	28	28	28	28	28	28	28	28	28	28
1900	29	82	18	61	0	86	108	119	158	177	28	28	28	28	28	26	28	28	28	28
1910	115	186	184	123	200	178	150	165	108	167	28	28	28	28	28	28	28	28	28	28
1920	152	92	147	138	127	99	113	114	110	129	28	28	28	28	28	28	28	28	28	28
1930	121	128	136	87	40	113	66	112	87	77	28	28	28	28	28	28	28	28	28	28
1940	62	132	97	110	111	100	42	89	53	103	28	28	28	28	28	28	28	28	28	23
1950	50	36	116	94	82	23	42	84	90	37	28	28	28	28	28	28	28	28	28	26
1960	114	47	94	62	29	81	112	98	101	138	28	28	28	28	28	28	28	28	28	28
1970	80	57									28	28								

SERIAL CORRELATION = .496 STANOARO OEVIATION = .472 MEAN SENSITIVITY = .475 N = 330

PUEBLITO CANYON NM USA OEAN, ROBINSON & BOWOEN
071000 PSME 84 3642N 10720W 2073M 329Y 1643:1971 24C SR: .31 SO: .51 MS: .51
AZ:360 SL:30 NOTES: PUB. IN "TREE-RING CHRON. FOR OENOROCLIMATIC ANALYSIS" 1976

DATE	TREE RING INOICES 0	1	2	3	4	5	6	7	8	9	NUMBER OF SAMPLES 0	1	2	3	4	5	6	7	8	9
1643				54	86	20	155	120	54	100				1	1	1	1	1	1	1
1650	119	302	125	196	103	186	124	31	28	43	1	1	2	2	2	2	2	2	2	2
1660	92	89	52	73	22	104	62	47	43	31	2	2	2	2	2	2	2	2	2	2
1670	49	91	105	88	122	86	42	59	116	144	2	2	2	2	2	2	2	2	2	2
1680	185	165	139	127	32	0	161	95	58	112	3	3	3	3	3	3	3	3	3	3
1690	152	101	171	166	72	112	40	70	113	104	3	3	3	3	3	3	3	3	3	3
1700	103	239	115	72	72	79	95	49	91	87	3	4	4	4	4	5	5	5	5	5
1710	119	131	144	134	60	104	48	62	86	67	7	7	7	7	7	7	7	7	7	8
1720	220	180	79	165	94	144	169	132	109	15	8	8	8	8	8	9	9	9	9	9
1730	86	75	119	82	99	19	77	52	53	35	9	9	9	9	9	9	9	9	9	9
1740	77	66	63	117	45	141	174	231	23	181	9	9	9	9	10	10	10	10	10	10
1750	84	65	38	65	126	91	36	48	52	111	10	10	10	10	10	10	10	10	10	10
1760	103	103	136	107	152	91	167	73	132	111	12	12	14	14	14	14	14	14	14	15
1770	151	197	158	34	123	75	65	61	61	65	15	15	15	15	15	15	15	15	15	15
1780	46	65	38	77	142	132	95	122	68	61	15	15	15	15	15	16	17	17	18	18
1790	56	96	113	189	135	108	121	74	94	121	18	18	18	18	19	20	20	20	20	20
1800	107	74	123	74	97	37	20	108	65	55	20	20	20	20	20	20	20	20	20	20
1810	43	55	74	61	82	96	256	223	77	45	20	20	20	20	20	20	20	20	20	20
1820	87	167	71	22	45	80	71	40	126	83	21	21	21	21	21	21	21	21	21	21
1830	98	128	111	154	119	130	78	123	146	194	21	21	21	21	22	22	22	22	22	22
1840	257	147	115	69	112	71	81	29	107	113	23	23	24	24	24	24	24	24	24	24
1850	133	40	165	149	142	171	221	98	138	100	24	24	24	24	24	24	24	24	24	24
1860	179	41	117	75	29	91	127	192	191	245	24	24	24	24	24	24	24	24	24	24
1870	64	88	73	52	127	89	43	141	101	73	24	24	24	24	24	24	24	24	24	24
1880	79	54	46	35	92	86	102	52	157	131	24	24	24	24	24	24	24	24	24	24
1890	67	138	89	45	43	115	26	149	95	15	24	24	24	24	24	24	24	24	24	24
1900	49	61	10	96	5	114	90	134	94	103	24	24	24	24	24	24	24	24	24	24
1910	86	118	122	73	151	184	222	166	41	142	24	24	24	24	24	24	24	24	24	24
1920	208	138	85	62	111	70	145	110	111	89	24	24	24	24	24	24	24	24	24	24
1930	119	76	190	139	67	120	130	145	108	76	24	24	24	24	24	24	24	24	24	24
1940	120	228	211	93	93	111	56	67	85	106	24	23	23	23	23	23	23	23	23	23
1950	22	11	106	58	59	46	24	46	99	46	23	23	23	23	23	23	23	23	23	23
1960	70	74	91	69	47	188	120	30	113	105	23	23	23	23	23	23	23	23	23	23
1970	81	64									23	23								

SERIAL CORRELATION = .311 STANOARO DEVIATION = .508 MEAN SENSITIVITY = .508 N = 329

SIERRA DEL CARMEN COA MEX C.W. STOCKTON & M.A. STOKES
271540 PSME 88 2856N 10237W 2042M 297Y 1675:1971 16C SR: .50 SD: .38 MS: .34
AZ:999 SL:99 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

	TREE RING INDICES										NUMBER OF SAMPLES									
DATE	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
1675						124	101	86	61	70						1	1	1	1	1
1680	101	108	85	70	68	68	125	141	99	65	1	1	1	1	1	1	1	1	1	1
1690	72	99	134	112	118	122	66	127	93	130	1	1	1	1	1	1	1	1	1	1
1700	97	83	73	79	60	68	93	80	92	108	2	2	2	2	2	2	2	2	2	2
1710	107	118	135	111	97	93	70	90	104	136	2	2	2	2	3	3	3	3	3	3
1720	118	168	111	145	91	79	124	106	107	104	4	4	4	5	5	5	5	5	5	5
1730	94	102	126	64	145	161	101	129	96	64	5	5	5	5	5	5	5	5	5	5
1740	88	75	53	83	99	98	113	136	95	89	5	5	5	5	5	5	6	6	6	6
1750	74	87	34	65	44	70	87	77	89	105	6	6	6	6	6	6	6	6	6	6
1760	95	97	68	21	36	68	84	70	87	118	6	6	6	6	6	6	6	6	6	6
1770	132	114	64	105	34	88	95	117	66	158	6	6	6	6	6	7	7	7	8	8
1780	184	167	119	193	165	80	58	39	80	34	8	8	8	8	8	8	8	8	8	8
1790	50	75	96	118	109	103	61	91	35	46	8	8	8	8	8	8	8	8	8	8
1800	61	11	79	73	61	32	73	93	85	106	8	8	8	8	8	8	8	8	8	8
1810	106	83	33	71	99	131	145	107	130	81	8	8	8	8	8	8	8	8	8	8
1820	116	145	121	90	170	159	163	204	156	193	8	8	8	8	9	9	9	9	9	9
1830	136	97	124	149	135	142	101	123	87	100	10	10	10	10	10	10	10	11	11	11
1840	59	87	92	103	128	135	132	81	153	116	11	11	11	11	11	11	11	11	11	12
1850	162	183	146	159	151	159	151	102	189	109	12	12	12	12	12	12	12	12	12	12
1860	85	100	37	99	82	82	92	102	73	176	12	13	13	13	13	13	13	13	13	13
1870	125	76	104	84	47	74	76	65	79	41	13	13	13	13	13	13	13	13	13	13
1880	74	95	102	96	65	85	45	66	79	95	14	14	14	14	14	14	14	14	14	14
1890	44	81	31	40	33	77	92	119	107	103	14	14	14	14	14	14	14	14	14	15
1900	143	105	87	146	65	112	111	53	98	56	15	16	16	16	16	16	16	16	16	16
1910	65	87	93	162	138	170	50	53	91	179	16	16	16	16	16	16	16	16	16	16
1920	163	116	84	140	100	85	136	120	126	69	16	16	16	16	16	16	16	16	16	16
1930	134	198	58	99	109	115	131	120	127	127	16	16	16	16	16	16	16	16	16	16
1940	228	245	151	101	138	71	120	95	43	138	16	16	16	16	16	16	16	16	16	16
1950	78	69	39	6	66	47	57	85	102	120	16	16	16	16	16	16	16	16	16	16
1960	64	99	66	40	93	93	110	55	148	59	16	16	16	16	16	16	16	16	16	16
1970	75	41									16	10								

SERIAL CORRELATION = .497 STANDARD DEVIATION = .385 MEAN SENSITIVITY = .341 N = 297

SIERRA MADRE/TRES RIOS CHI MEX STOKES, HARLAN & HOLMES
167649 PIPO 99 3029N 10830W 2347M 330Y 1636:1965 21C SR: .27 SD: .30 MS: .29
AZ:999 SL:99 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

	TREE RING INDICES										NUMBER OF SAMPLES									
DATE	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
1636							105	67	106	133							1	1	1	1
1640	154	89	125	103	78	104	70	89	43	53	1	1	1	1	1	1	1	1	1	1
1650	89	101	54	35	62	108	56	51	79	157	1	1	1	1	1	1	1	1	1	1
1660	199	92	90	60	59	103	60	56	71	86	1	1	1	1	1	1	1	1	1	1
1670	70	140	113	116	174	134	143	162	128	115	1	1	1	1	1	1	1	1	1	1
1680	154	84	176	159	116	47	153	81	101	123	1	1	1	1	1	1	1	1	1	1
1690	204	121	146	117	153	109	56	122	4	140	1	1	1	1	1	1	1	1	1	1
1700	115	124	174	165	162	109	112	83	92	89	1	1	1	1	1	1	1	1	1	1
1710	141	103	140	112	132	104	99	88	125	92	1	1	1	1	1	1	1	1	1	1
1720	109	106	149	69	90	71	102	76	100	86	1	1	1	1	1	1	1	1	1	1
1730	144	136	128	90	134	118	137	123	97	105	1	1	1	1	1	1	1	1	1	1
1740	106	166	34	85	77	90	115	109	84	115	1	1	1	1	1	2	3	4	4	4
1750	117	113	72	87	95	89	96	33	98	100	8	8	8	8	8	8	8	9	9	9
1760	78	65	92	59	107	113	105	88	89	128	10	10	11	11	11	13	13	13	13	13
1770	101	99	73	94	86	78	104	102	57	106	13	13	13	13	13	13	13	13	13	13
1780	111	118	63	117	140	87	103	108	117	99	13	13	13	13	13	13	13	14	14	14
1790	124	151	96	126	76	108	129	103	62	117	15	15	15	15	15	15	15	15	15	15
1800	106	80	103	57	109	55	79	75	61	86	16	16	16	16	16	16	16	16	16	16
1810	97	109	87	107	122	137	114	98	110	55	16	16	16	16	17	18	18	18	18	19
1820	52	90	110	112	100	83	98	148	120	136	20	20	20	20	20	20	20	20	20	20
1830	87	85	93	113	108	94	83	112	81	128	20	20	20	20	20	20	20	20	20	20
1840	79	99	66	100	114	104	96	60	82	93	20	20	20	20	20	20	20	20	20	20
1850	97	68	131	123	111	64	105	99	109	94	20	20	20	20	20	20	21	21	21	21
1860	108	107	80	73	62	86	90	84	82	104	21	21	21	21	21	21	21	21	21	21
1870	108	96	86	76	77	89	112	68	111	74	21	21	21	21	21	21	21	21	21	21
1880	57	72	93	80	107	117	97	37	136	93	21	21	21	21	21	21	21	21	21	21
1890	77	79	102	87	109	122	111	146	172	131	21	21	21	21	21	21	21	21	21	21
1900	121	146	48	116	20	155	115	123	121	117	21	21	21	21	21	21	21	21	21	21
1910	86	70	85	109	132	209	102	124	123	150	21	21	21	21	21	21	21	21	21	21
1920	137	95	132	143	139	74	134	145	138	112	21	21	21	21	21	21	21	21	21	21
1930	122	139	130	145	52	88	81	91	93	57	21	21	21	21	21	21	21	21	21	21
1940	111	157	137	129	132	96	117	98	95	125	21	21	21	21	21	21	21	21	21	21
1950	104	77	93	71	51	85	21	94	118	82	21	21	21	21	21	21	21	21	21	21
1960	76	66	92	73	98	83					21	21	21	21	21	21				

SERIAL CORRELATION = .267 STANDARD DEVIATION = .299 MEAN SENSITIVITY = .287 N = 330

OAK CREEK (APACHE RES.) AZ USA J.S. OEAN & R.L. WARREN
033000 PIED 93 3403N 11040W 1707M 277Y 1695:1971 22C SR: .44 SO: .34 MS: .32
AZ:315 SL:30 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

	TREE RING INDICES										NUMBER OF SAMPLES									
OATE	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
1695						89	61	65	84	149						1	1	1	3	3
1700	121	109	118	105	120	115	113	85	71	102	3	3	3	3	3	3	3	3	3	3
1710	114	89	84	90	101	92	110	116	114	105	4	4	4	4	4	4	4	4	4	4
1720	[illegible]	117	89	113	93	143	134	81	85	40	4	4	4	4	4	4	4	4	4	4
1730	[illegible]	80	91	62	109	47	99	98	122	76	4	4	4	4	4	4	4	4	4	4
1740	96	108	114	107	111	108	146	129	40	114	4	4	4	4	4	4	4	4	4	4
1750	104	100	17	71	92	64	70	104	107	128	4	4	4	4	4	4	4	4	4	4
1760	116	93	129	76	144	107	135	121	126	116	4	4	4	4	4	4	4	4	4	4
1770	132	153	111	80	112	88	87	87	85	89	4	4	4	4	4	4	4	4	4	4
1780	87	88	66	111	145	96	110	126	130	132	4	4	4	4	4	4	4	4	4	4
1790	116	131	109	130	80	102	72	57	44	61	5	5	5	5	5	5	5	5	5	5
1800	57	39	105	61	88	102	84	105	111	102	6	6	6	6	6	6	6	7	7	7
1810	114	106	102	51	89	102	120	114	85	81	10	10	10	10	10	11	11	11	11	11
1820	38	85	83	49	72	127	130	102	120	85	17	17	17	17	17	17	17	17	17	17
1830	106	105	129	125	132	111	119	105	119	128	20	20	20	20	20	20	20	20	20	20
1840	86	55	61	73	107	43	88	13	96	133	21	21	21	21	21	21	21	21	21	21
1850	142	120	130	108	102	111	83	45	98	58	21	21	21	21	21	21	21	21	21	21
1860	99	58	106	83	45	114	142	152	114	94	22	22	22	22	22	22	22	22	22	22
1870	80	25	80	92	133	162	132	132	117	101	22	22	22	22	22	22	22	22	22	22
1880	77	54	97	98	147	167	132	75	117	119	22	22	22	22	22	22	22	22	22	22
1890	155	152	89	61	48	102	113	147	118	107	22	22	22	22	22	22	22	22	22	22
1900	67	117	42	115	6	187	212	209	238	197	22	22	22	22	22	22	22	22	22	22
1910	103	173	124	69	105	132	136	124	60	134	22	22	22	22	22	22	22	22	22	22
1920	142	69	68	40	60	46	75	76	61	98	22	22	22	22	22	22	22	22	22	22
1930	84	102	111	92	23	91	63	116	66	60	22	22	22	22	22	22	22	22	22	22
1940	62	122	86	82	84	72	17	54	50	80	22	22	22	22	22	22	22	22	22	22
1950	66	82	142	105	106	50	30	90	99	65	22	22	22	22	22	22	22	22	22	22
1960	145	88	118	103	90	150	155	115	144	160	22	22	22	22	22	22	22	22	22	22
1970	124	109									22	22								

SERIAL CORRELATION = .439 STANOARO DEVIATION = .342 MEAN SENSITIVITY = .322 N = 277

SALT RIVER DRAW AZ USA J.S. DEAN & R.L. WARREN
042000 PIPO 94 3403N 11039W 1817M 295Y 1677:1971 20C SR: .61 SO: .58 MS: .51
AZ:315 SL: 7 NOTES: PUB. IN "TREE-RING CHRON. FOR DENOROCLIMATIC ANALYSIS" 1976

	TREE RING INOICES										NUMBER OF SAMPLES									
OATE	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
1677								48	72	105								1	1	1
1680	99	85	105	84	21	5	37	61	86	89	2	2	2	2	2	2	2	2	2	2
1690	96	102	146	137	158	156	76	45	71	128	2	2	2	2	2	2	2	2	2	2
1700	131	175	199	178	163	[illegible]	174	75	68	33	2	2	2	2	2	2	2	2	2	2
1710	56	74	105	136	213	98	36	72	118	141	2	2	2	2	2	2	2	2	2	2
1720	176	148	87	149	78	146	147	63	44	0	2	2	2	2	2	2	2	2	2	2
1730	79	47	99	28	60	0	16	59	91	71	2	2	2	2	2	2	2	2	2	2
1740	122	155	84	151	117	198	288	232	79	378	2	2	2	2	2	2	2	2	2	2
1750	282	121	13	15	19	6	16	11	36	96	2	2	2	2	2	2	2	2	2	2
1760	117	29	161	66	171	95	184	171	212	126	2	2	2	2	2	2	2	2	2	2
1770	105	222	191	25	65	98	129	62	33	85	2	2	2	2	2	2	2	2	2	2
1780	4	9	2	33	42	22	54	109	39	100	2	2	2	2	2	2	2	2	2	2
1790	49	116	193	269	161	214	119	39	52	71	2	2	2	2	2	2	2	2	2	2
1800	6	0	39	0	41	38	69	86	91	69	2	2	2	2	2	2	2	2	2	2
1810	77	94	62	69	95	169	181	131	92	69	4	4	4	4	4	5	5	6	6	6
1820	27	80	36	14	54	79	101	88	134	74	8	8	8	8	8	8	9	9	9	10
1830	101	108	94	109	124	101	114	84	111	157	11	11	12	12	12	12	12	12	12	12
1840	133	55	46	59	130	31	53	6	52	88	12	12	12	12	12	12	12	12	12	12
1850	101	128	140	116	108	133	114	83	144	85	12	12	12	12	12	12	12	12	12	12
1860	109	49	105	80	18	111	165	170	[illegible]	246	12	12	12	12	12	12	12	12	12	12
1870	132	35	66	31	67	105	99	94	142	100	12	12	12	12	12	12	12	12	12	12
1880	65	46	64	93	138	176	137	67	99	98	12	12	12	12	12	12	13	14	14	14
1890	116	96	92	43	28	64	70	97	106	74	15	15	15	16	16	16	16	16	17	18
1900	30	67	20	58	3	81	92	125	193	181	18	18	18	19	19	20	20	20	20	20
1910	130	151	137	103	152	174	142	192	152	196	20	20	20	20	20	20	20	20	20	20
1920	180	130	136	136	127	109	107	135	145	181	20	20	20	20	20	20	20	20	20	20
1930	145	167	140	115	66	116	86	111	81	79	20	20	20	20	20	20	20	20	20	20
1940	67	115	122	98	124	93	43	57	42	73	20	20	20	20	20	20	20	20	20	20
1950	55	34	93	93	81	37	29	63	69	45	20	20	20	20	20	20	20	20	20	20
1960	77	61	80	72	45	78	101	115	111	129	20	20	20	20	20	20	20	20	20	20
1970	95	77									20	20								

SERIAL CORRELATION = .608 STANOARO OEVIATION = .576 MEAN SENSITIVITY = .508 N = 295

CROSS CANYON AZ USA J.S. DEAN & W.J. ROBINSON
252000 PIPO 95 3540N 10 20W 2195M 362Y 1611:1972 22C SR: .46 SD: .41 MS: .39
AZ:360 SL: 0 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

TREE RING INDICES

DATE	0	1	2	3	4	5	6	7	8	9
1611		94	71	32	55	65	53	128	155	154
1620	103	78	58	65	76	107	49	100	82	93
1630	108	124	70	148	124	136	117	97	69	95
1640	124	106	99	110	112	118	110	120	96	119
1650	138	161	162	93	49	70	101	74	68	109
1660	117	107	131	135	116	144	105	78	59	48
1670	30	82	117	86	131	88	46	80	95	77
1680	103	110	127	153	47	30	83	98	115	136
1690	134	114	164	137	151	149	108	130	118	128
1700	44	142	125	88	38	73	114	67	27	79
1710	106	88	61	46	77	50	46	62	102	112
1720	177	106	111	146	90	208	239	141	80	11
1730	70	60	111	102	94	19	45	56	81	52
1740	66	74	98	134	96	132	174	150	21	148
1750	84	86	28	50	55	59	73	111	149	105
1760	130	100	113	55	147	53	149	151	158	125
1770	104	168	167	94	120	111	116	41	36	80
1780	44	68	52	111	186	44	121	127	57	99
1790	94	164	158	202	179	138	126	75	107	124
1800	106	65	96	74	126	79	46	101	74	72
1810	49	65	77	89	94	93	109	87	18	7
1820	2	57	2	23	56	70	85	68	126	54
1830	97	59	35	96	67	111	107	124	118	156
1840	105	81	66	54	138	84	100	17	110	132
1850	127	58	154	165	152	151	152	68	177	100
1860	85	30	115	78	80	118	134	130	239	138
1870	154	55	65	34	63	61	60	104	124	80
1880	55	45	61	66	87	116	92	70	91	120
1890	127	105	107	110	51	79	81	89	98	53
1900	23	91	4	91	29	95	101	150	148	159
1910	112	137	90	96	170	150	175	162	137	187
1920	127	145	118	141	141	132	160	164	88	186
1930	145	148	130	88	91	115	118	123	86	116
1940	135	171	162	151	132	156	78	103	117	148
1950	86	45	128	78	71	66	59	99	61	22
1960	93	83	101	62	63	123	100	109	123	137
1970	102	64	114							

NUMBER OF SAMPLES

DATE	0	1	2	3	4	5	6	7	8	9
1611		1	1	1	1	1	1	1	1	1
1620	1	1	1	1	2	2	3	3	3	3
1630	3	3	3	3	3	3	3	3	3	4
1640	5	5	5	5	5	5	5	5	5	5
1650	6	6	6	6	6	6	7	7	7	8
1660	8	8	8	8	8	8	8	8	8	9
1670	9	9	9	9	9	9	9	9	9	9
1680	15	16	16	16	16	16	16	16	16	17
1690	17	18	18	18	18	18	19	19	19	19
1700	19	19	19	19	19	19	19	19	19	19
1710	19	19	19	19	19	19	19	19	19	19
1720	19	19	19	19	19	19	20	20	20	20
1730	21	21	21	21	21	21	21	21	21	21
1740	21	21	21	21	21	21	21	21	21	21
1750	22	22	22	22	22	22	22	22	22	22
1760	22	22	22	22	22	22	22	22	22	22
1770	22	22	22	22	22	22	22	22	22	22
1780	22	22	22	22	22	22	22	22	22	22
1790	22	22	22	22	22	22	22	22	22	22
1800	22	22	22	22	22	22	22	22	22	22
1810	22	22	22	22	22	22	22	22	22	22
1820	22	22	22	22	22	22	22	22	22	22
1830	22	22	22	22	22	22	22	22	22	22
1840	22	22	22	22	22	22	22	22	22	22
1850	22	22	22	22	22	22	22	22	22	22
1860	22	22	22	22	22	22	22	22	22	22
1870	22	22	22	22	22	22	22	22	22	22
1880	22	22	22	22	22	22	22	22	22	22
1890	22	22	22	22	22	22	22	22	22	22
1900	22	22	22	22	22	22	22	22	22	22
1910	22	22	22	22	22	22	22	22	22	22
1920	22	22	22	22	22	22	22	22	22	22
1930	22	22	22	22	22	22	22	22	22	22
1940	22	22	22	22	22	22	22	22	22	22
1950	22	22	22	22	22	22	22	22	22	22
1960	22	22	22	22	22	22	22	22	22	22
1970	22	22	22							

SERIAL CORRELATION = .464 STANDARD DEVIATION = .410 MEAN SENSITIVITY = .390 N = 362

OEFIANCE PLATEAU   AZ   USA   J.S. DEAN & R. L. WARREN
243000 PIEO 96 3542N 10922W 2134M 353Y 1620:1972 20C SR: .40 SD: .44 MS: .47
AZ:999 SL: 5 NOTES: PUB. IN "TREE-RING CHRON. FOR OENDROCLIMATIC ANALYSIS" 1976

	TREE RING INDICES										NUMBER OF SAMPLES									
OATE	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
1620	64	95	101	42	13	163	0	148	142	164	1	1	1	1	1	1	1	1	2	2
1630	121	86	55	129	106	86	63	77	61	80	2	2	2	2	2	2	2	2	2	2
1640	101	98	90	90	91	104	69	77	54	82	2	2	2	2	2	2	2	2	2	2
1650	109	105	126	90	116	138	172	146	156	183	2	2	2	2	2	2	2	2	2	2
1660	155	117	89	120	115	108	83	96	36	69	2	2	2	2	2	2	2	2	2	2
1670	30	86	108	121	106	81	58	117	99	73	2	2	2	2	2	2	2	2	2	2
1680	156	135	105	108	56	42	82	97	116	126	2	3	3	4	4	4	4	4	4	4
1690	113	130	170	127	142	132	95	88	106	125	6	6	7	7	7	8	9	10	10	10
1700	75	116	100	78	81	121	144	58	42	100	11	11	11	12	12	12	13	13	13	13
1710	124	111	78	41	73	70	85	90	124	107	13	13	13	13	13	13	13	13	13	13
1720	173	113	135	120	92	158	186	144	72	32	16	16	16	16	17	17	17	17	17	17
1730	103	98	128	115	102	19	69	69	98	55	17	17	17	17	17	17	17	17	17	17
1740	91	104	70	132	89	161	155	185	30	141	17	17	17	17	17	17	17	17	17	17
1750	90	87	54	55	107	57	94	116	147	114	17	17	17	17	17	17	17	17	18	18
1760	130	63	96	20	103	36	125	103	133	92	18	18	18	18	18	18	18	18	18	18
1770	80	99	119	57	106	103	100	37	24	92	19	19	19	19	19	19	19	19	19	19
1780	75	84	76	105	174	60	128	187	83	99	19	19	19	19	19	20	20	20	20	20
1790	70	141	141	154	140	125	131	86	113	103	20	20	20	20	20	20	20	20	20	20
1800	109	53	92	51	121	59	10	120	66	85	20	20	20	20	20	20	20	20	20	20
1810	51	94	86	76	88	121	145	121	0	22	20	20	20	20	20	20	20	20	20	20
1820	3	86	2	26	77	99	118	97	170	89	20	20	20	20	20	20	20	20	20	20
1830	116	91	44	150	99	144	120	168	182	194	20	20	20	20	20	20	20	20	20	20
1840	182	94	67	92	148	76	87	1	84	190	20	20	20	20	20	20	20	20	20	20
1850	163	61	158	119	64	105	108	49	128	85	20	20	20	20	20	20	20	20	20	20
1860	27	4	108	59	49	134	160	202	194	139	20	20	20	20	20	20	20	20	20	20
1870	92	45	33	49	78	61	66	78	77	41	20	20	20	20	20	20	20	20	20	20
1880	20	10	59	32	86	99	80	51	88	94	20	20	20	20	20	20	20	20	20	20
1890	90	121	102	82	57	101	65	94	77	34	20	20	20	20	20	20	20	20	20	20
1900	10	72	1	96	21	124	139	160	106	129	20	20	20	20	20	20	20	20	20	20
1910	173	191	153	137	205	191	235	176	109	188	20	20	20	20	20	20	20	20	20	20
1920	193	139	109	78	127	127	132	150	53	114	20	20	20	20	20	20	20	20	20	20
1930	114	114	159	109	73	115	79	162	125	138	20	20	20	20	20	20	20	20	20	20
1940	107	199	195	118	134	163	84	70	126	150	20	20	20	20	20	20	20	20	20	20
1950	65	17	129	71	89	72	40	100	83	10	20	20	20	20	20	20	20	20	20	20
1960	97	78	119	73	53	165	112	63	124	150	20	20	20	20	20	20	20	20	20	20
1970	111	69	104								20	20	20							

SERIAL CORRELATION = .400 STANOARO OEVIATION = .439 MEAN SENSITIVITY = .469 N = 353

SPIDER ROCK, CANYON DE CHELLY AZ USA J.S. DEAN & W.J. ROBINSON
081000 PSME 97 3606N 10921W 1890M 375Y 1598:1972 26C SR: .52 SD: .41 MS: .36
AZ:360 SL:30 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

TREE RING INDICES

DATE	0	1	2	3	4	5	6	7	8	9
1598									84	68
1600	35	44	62	69	78	76	84	45	88	89
1610	123	138	94	97	100	130	117	153	208	110
1620	172	227	140	66	34	69	23	65	71	102
1630	126	87	70	92	120	108	70	51	71	74
1640	106	121	120	88	118	123	114	105	62	103
1650	103	156	135	131	68	177	137	108	100	129
1660	123	126	75	100	45	116	89	70	45	55
1670	17	46	69	110	135	99	91	95	144	73
1680	118	148	116	137	92	44	98	93	123	133
1690	124	126	123	171	116	116	61	72	132	131
1700	45	120	97	108	76	110	119	72	92	77
1710	124	111	134	62	125	111	72	65	97	138
1720	199	206	132	146	88	171	188	160	62	13
1730	55	72	88	96	65	33	77	58	74	43
1740	42	74	59	131	131	146	214	239	96	169
1750	121	96	75	20	[illegible]	39	40	55	67	99
1760	108	90	93	85	117	90	147	121	141	116
1770	96	136	115	55	90	54	50	49	43	66
1780	31	56	53	99	128	105	95	128	53	61
1790	29	112	126	126	106	74	102	144	122	133
1800	121	57	121	120	139	79	62	115	84	79
1810	33	67	99	52	79	103	165	133	40	37
1820	25	116	25	57	71	97	104	108	145	79
1830	119	115	53	128	87	154	122	145	161	205
1840	164	102	48	78	126	95	76	19	105	116
1850	143	63	129	144	119	178	136	99	152	119
1860	71	20	84	91	76	99	130	176	150	200
1870	156	145	57	83	93	62	91	105	118	136
1880	102	77	100	108	110	115	99	67	123	123
1890	139	134	157	77	39	70	42	69	70	28
1900	63	61	6	75	54	96	111	136	105	146
1910	119	169	198	102	151	180	140	150	92	164
1920	190	130	164	101	144	106	160	126	116	99
1930	117	124	125	75	83	82	74	113	113	94
1940	97	128	148	113	137	113	76	93	131	134
1950	61	20	99	55	44	55	43	50	70	17
1960	75	59	74	90	64	116	113	47	106	94
1970	116	75								

NUMBER OF SAMPLES

DATE	0	1	2	3	4	5	6	7	8	9
1598									1	1
1600	1	1	1	1	1	1	2	2	2	2
1610	2	2	2	2	2	2	2	2	2	2
1620	2	2	2	2	2	2	2	2	3	3
1630	3	3	3	3	3	3	3	3	4	4
1640	4	4	4	5	5	5	5	5	5	5
1650	5	5	6	6	6	6	7	7	7	7
1660	7	7	7	7	8	8	8	8	8	8
1670	8	8	8	8	8	8	8	8	8	8
1680	8	8	8	9	9	9	9	9	9	9
1690	9	9	9	10	13	13	13	13	13	13
1700	14	14	15	15	15	15	15	15	15	15
1710	15	15	15	15	15	15	15	15	15	15
1720	15	15	16	16	16	16	16	16	17	17
1730	18	18	18	18	18	18	18	19	19	19
1740	19	19	19	19	20	20	20	20	20	20
1750	20	20	20	20	21	21	21	21	21	21
1760	21	22	22	22	22	22	22	22	22	22
1770	22	23	23	23	23	23	23	23	23	23
1780	23	23	23	23	23	23	23	23	23	23
1790	23	23	23	23	23	23	23	23	23	23
1800	23	23	23	23	23	23	23	23	23	23
1810	23	23	23	23	23	23	23	23	23	23
1820	24	24	24	24	24	24	24	24	24	24
1830	24	24	24	24	24	24	24	24	24	24
1840	24	24	24	24	24	24	24	24	24	24
1850	25	25	25	25	26	26	26	26	26	26
1860	26	26	26	26	26	26	26	26	26	26
1870	26	26	26	26	26	26	26	26	26	26
1880	26	26	26	26	26	26	26	26	26	26
1890	26	26	26	26	26	26	26	26	26	26
1900	26	26	26	26	26	26	26	26	26	26
1910	26	26	26	26	26	26	26	26	26	26
1920	26	26	26	26	26	26	26	26	26	26
1930	26	26	26	26	26	26	26	26	26	26
1940	26	26	26	26	26	26	26	26	26	26
1950	26	26	26	26	26	26	26	26	26	26
1960	26	26	26	26	26	26	26	26	26	26
1970	22	22								

SERIAL CORRELATION = .522 STANDARD DEVIATION = .406 MEAN SENSITIVITY = .365 N = 374

CANYON DE CHELLY AZ USA J.S. DEAN & W.J. ROBINSON
091000 PSME 98 3606N 10923W 1829M 597Y 1376:1972 15C SR: .48 SD: .29 MS: .25
AZ:315 SL:35 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

	TREE RING INDICES										NUMBER OF SAMPLES									
DATE	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
1376							100	101	84	101							1	1	1	1
1380	113	139	48	76	89	50	80	78	88	89	1	1	1	1	1	1	1	1	1	2
1390	77	79	90	106	116	123	119	98	82	75	2	2	2	2	2	2	2	2	2	2
1400	77	71	75	88	102	105	113	115	85	110	2	2	3	3	3	3	3	3	3	4
1410	97	111	101	73	125	81	102	126	94	114	4	4	4	4	4	4	4	4	4	4
1420	131	98	136	104	115	103	127	127	162	156	4	4	4	4	4	5	5	5	5	5
1430	123	112	101	98	136	82	75	60	73	77	6	6	6	6	6	6	6	6	6	6
1440	126	135	95	89	93	67	98	124	43	66	6	6	6	6	6	6	6	6	6	7
1450	47	102	95	118	109	53	120	55	97	82	7	7	7	7	7	7	7	7	7	7
1460	51	122	122	116	61	121	140	179	164	148	7	7	7	7	7	7	7	7	8	8
1470	146	46	63	77	107	76	98	150	97	111	8	8	8	8	8	8	9	9	9	9
1480	63	81	70	81	107	114	140	128	79	99	9	9	9	9	9	9	9	9	9	9
1490	77	99	121	141	128	33	73	78	113	107	9	9	9	9	9	9	9	9	9	9
1500	71	72	85	88	117	102	68	118	125	146	9	9	9	9	9	9	9	9	9	9
1510	114	162	136	110	133	108	66	59	70	103	9	9	9	9	9	9	9	9	9	9
1520	76	76	51	76	95	75	157	109	90	110	9	9	9	9	9	9	9	9	9	9
1530	142	130	50	123	100	134	143	161	68	136	9	9	9	9	9	9	9	9	9	9
1540	162	133	62	107	89	74	61	61	84	107	9	9	9	9	9	9	9	9	9	9
1550	131	102	136	142	95	191	182	101	104	97	9	9	9	9	9	9	9	9	9	9
1560	103	67	70	118	121	130	103	109	124	132	9	9	9	9	9	9	9	9	9	9
1570	140	72	130	62	112	80	80	75	90	37	9	9	9	9	9	9	9	9	9	9
1580	41	66	54	59	5	22	60	38	73	50	9	9	9	9	9	9	9	9	9	9
1590	32	71	42	75	136	86	99	95	72	80	9	9	9	9	9	9	9	9	9	9
1600	64	60	78	70	74	84	96	68	98	92	10	10	10	10	10	10	10	10	10	10
1610	109	86	84	87	80	105	99	94	146	98	10	10	10	10	10	10	10	10	10	10
1620	141	134	126	68	44	73	39	61	56	81	10	10	10	10	10	10	10	10	10	10
1630	93	77	91	79	102	90	63	66	88	92	10	10	10	10	10	10	10	10	10	10
1640	112	104	110	94	127	112	124	109	89	132	11	11	11	11	11	11	11	11	11	11
1650	118	152	106	137	91	135	112	89	90	95	11	11	11	11	11	11	11	11	12	12
1660	82	99	88	142	65	153	110	106	56	90	12	12	12	12	12	12	12	12	12	12
1670	52	71	75	99	116	113	90	98	117	71	12	12	12	12	12	12	12	12	12	12
1680	104	134	115	119	71	38	112	103	102	96	12	12	12	13	13	13	13	13	13	13
1690	108	105	106	139	93	94	66	60	96	102	13	13	13	13	13	13	13	13	13	13
1700	59	97	82	95	64	90	91	60	86	67	13	13	13	13	13	13	13	13	13	13
1710	100	91	111	72	101	100	65	80	98	124	13	13	14	14	14	14	14	14	14	14
1720	141	154	140	164	92	199	191	151	83	38	14	14	14	14	14	14	14	14	14	14
1730	70	75	84	84	69	52	88	55	63	62	14	14	14	14	14	14	14	14	14	14
1740	40	66	58	94	92	103	133	155	85	132	14	14	14	14	14	14	14	14	14	14
1750	104	105	90	61	96	67	60	66	94	106	14	14	14	14	14	14	14	14	14	14
1760	106	93	104	67	100	81	115	85	91	103	14	14	14	14	14	14	14	14	14	14
1770	83	110	96	50	89	71	82	74	78	88	14	14	14	14	14	14	14	14	14	14
1780	53	96	104	119	166	188	142	191	113	112	15	15	15	15	15	15	15	15	15	15
1790	128	141	157	177	165	148	138	184	129	133	15	15	15	15	15	15	15	15	15	15
1800	147	96	119	122	121	101	94	93	113	93	15	15	15	15	15	15	15	15	15	15
1810	69	105	117	81	113	147	171	130	72	81	15	15	15	15	15	15	15	15	15	15
1820	50	124	47	94	96	109	109	115	110	92	15	15	15	15	15	15	15	15	15	15
1830	105	114	100	110	111	133	114	136	119	152	15	15	15	15	15	15	15	15	15	15
1840	110	134	82	98	116	97	107	73	109	126	15	15	15	15	15	15	15	15	15	15
1850	132	86	132	132	114	126	102	106	147	120	15	15	15	15	15	15	15	15	15	15
1860	103	84	104	99	114	110	131	135	137	159	15	15	15	15	15	15	15	15	15	15
1870	128	134	89	103	92	87	115	111	136	134	15	15	15	15	15	15	15	15	15	15
1880	106	98	111	118	116	121	106	89	108	99	15	15	15	15	15	15	15	15	15	15
1890	114	114	118	79	84	96	71	70	94	60	15	15	15	15	15	15	15	15	15	15
1900	93	80	48	85	58	94	105	117	110	105	15	15	15	15	15	15	15	15	15	15
1910	114	96	131	85	110	129	116	125	81	124	15	15	15	15	15	15	15	15	15	15
1920	134	104	136	108	113	82	129	93	114	88	15	15	15	15	15	15	15	15	15	15
1930	118	105	108	103	92	103	80	130	97	88	15	15	15	15	15	15	15	15	15	15
1940	104	114	105	76	102	78	80	93	95	98	15	15	15	15	15	15	15	15	15	15
1950	86	55	88	83	68	87	77	67	79	54	15	15	15	15	15	15	15	15	15	15
1960	84	70	77	82	76	124	88	82	108	82	15	15	15	15	15	15	15	15	15	15
1970	94	79	64								10	10	1							

SERIAL CORRELATION = .482 STANDARD DEVIATION = .292 MEAN SENSITIVITY = .250 N = 597

ROBINSON MTN. I. AZ USA J.S. DEAN & D.O BOWDEN
212000 PIPO 99 3524N 11132W 2225M 362Y 1611:1972 20C SR: .32 SD: .37 MS: .39
AZ:360 SL: 3 NOTES: PUB. IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

DATE	TREE RING INDICES 0	1	2	3	4	5	6	7	8	9	NUMBER OF SAMPLES 0	1	2	3	4	5	6	7	8	9
1611		145	88	59	152	112	153	93	103	91		1	1	1	1	1	2	2	2	2
1620	141	151	76	46	33	50	42	89	113	118	2	2	2	2	2	2	2	2	2	2
1630	144	108	31	52	107	132	63	106	66	76	2	2	2	2	2	2	2	2	2	2
1640	123	101	84	92	112	18	12	36	37	92	2	2	2	2	2	2	2	2	2	2
1650	87	131	85	123	63	131	147	105	158	130	2	2	2	2	2	2	2	2	2	2
1660	140	150	141	162	150	168	53	132	86	91	2	2	2	2	2	2	2	2	2	2
1670	46	124	146	144	126	99	89	142	174	53	2	2	2	3	3	4	4	4	4	4
1680	148	118	125	119	56	68	83	151	137	163	4	4	4	4	4	4	4	4	4	4
1690	108	119	161	118	103	107	80	70	103	99	4	4	4	4	4	4	4	4	4	4
1700	49	133	109	70	101	111	78	84	94	63	4	4	4	4	4	4	4	4	4	4
1710	125	108	114	106	83	82	39	83	114	113	4	4	4	4	4	4	4	4	4	4
1720	148	131	75	128	76	125	149	88	87	48	5	6	7	7	7	7	7	7	7	7
1730	86	70	97	64	86	37	114	56	117	74	7	7	8	8	8	8	8	9	9	10
1740	83	89	64	121	101	98	153	107	46	141	10	10	10	10	10	10	10	10	10	11
1750	89	103	38	94	146	67	133	136	176	122	11	11	11	11	11	12	13	13	14	14
1760	134	86	110	74	144	99	126	100	119	112	15	15	15	15	15	16	16	16	17	17
1770	99	133	80	37	79	76	110	96	92	93	18	18	18	18	18	18	18	18	18	18
1780	79	82	85	104	119	47	53	96	64	64	18	18	18	18	18	18	18	18	18	18
1790	79	104	119	190	126	143	164	132	76	170	20	20	20	20	20	20	20	20	20	20
1800	112	65	94	49	93	58	79	100	109	111	20	20	20	20	20	20	20	20	20	20
1810	118	121	123	32	92	110	126	106	69	51	20	20	20	20	20	20	20	20	20	20
1820	55	89	56	79	94	132	156	128	177	84	20	20	20	20	20	20	20	20	20	20
1830	133	160	115	142	84	124	70	96	133	168	20	20	20	20	20	20	20	20	20	20
1840	139	105	63	107	106	44	59	6	90	119	20	20	20	20	20	20	20	20	20	20
1850	139	82	141	108	110	99	77	7	105	48	20	20	20	20	20	20	20	20	20	20
1860	90	83	95	48	25	98	143	118	193	102	20	20	20	20	20	20	20	20	20	20
1870	135	98	102	85	119	106	81	53	90	26	20	20	20	20	20	20	20	20	20	20
1880	41	48	91	89	122	109	79	93	116	143	20	20	20	20	20	20	20	20	20	20
1890	150	173	136	91	149	101	54	113	97	59	20	20	20	20	20	20	20	20	20	20
1900	49	68	7	104	12	104	93	142	158	161	20	20	20	20	20	20	20	20	20	20
1910	158	183	144	61	105	141	121	167	150	177	20	20	20	20	20	20	20	20	20	20
1920	165	121	161	127	143	105	115	62	93	102	20	20	20	20	20	20	20	20	20	20
1930	80	86	124	127	71	81	54	73	62	52	20	20	20	20	20	20	20	20	20	20
1940	46	121	105	51	113	90	106	47	97	145	20	20	20	20	20	20	20	20	20	20
1950	81	14	113	78	52	97	73	95	79	76	20	20	20	20	20	20	20	20	20	20
1960	102	150	125	42	126	119	123	125	120	109	20	20	20	20	20	20	20	20	20	20
1970	137	14	145								20	20	2							

SERIAL CORRELATION = .318 STANDARD DEVIATION = .371 MEAN SENSITIVITY = .395 N = 362

CEBOLLETA I. NM USA J.S. DEAN & W. WOOLFENDEN
303099 PIPO 102 3455N 10750W 2134M 311Y 1662:1972 20C SR: .26 SD: .41 MS: .42
AZ:270 SL:45 NOTES: PUB IN "TREE-RING CHRON. FOR DENDROCLIMATIC ANALYSIS" 1976

DATE	TREE RING INDICES 0	1	2	3	4	5	6	7	8	9	NUMBER OF SAMPLES 0	1	2	3	4	5	6	7	8	9
1662			291	132	93	162	158	81	44	138			1	1	1	1	1	1	1	1
1670	65	59	111	97	129	97	59	72	72	99	1	1	1	1	1	1	1	1	1	2
1680	101	61	71	88	84	46	75	78	124	131	2	2	2	2	2	2	2	2	2	2
1690	94	62	107	85	93	102	68	94	79	156	2	2	2	2	2	2	3	4	4	4
1700	139	117	90	112	69	119	154	50	82	85	4	4	4	4	5	5	5	5	6	7
1710	123	72	116	63	85	86	100	88	126	85	7	7	7	7	7	7	8	8	8	8
1720	151	115	119	103	70	125	141	79	50	31	9	9	10	10	10	10	10	10	10	10
1730	81	83	70	74	95	97	127	74	93	95	10	10	10	10	10	10	10	10	10	10
1740	67	121	76	118	114	161	186	148	10	123	12	12	13	13	13	14	14	14	15	15
1750	50	147	72	124	98	55	60	115	131	137	15	15	15	15	15	15	16	16	16	16
1760	56	111	100	67	98	110	118	127	121	71	16	16	16	16	16	16	16	16	16	16
1770	123	157	73	58	70	103	94	57	150	52	16	16	16	16	16	16	16	16	17	17
1780	31	80	71	150	141	116	83	121	88	63	19	19	19	19	19	19	19	19	19	19
1790	119	141	115	166	97	100	87	106	119	115	20	20	20	20	20	20	20	20	20	20
1800	150	118	91	93	98	66	50	94	97	141	20	20	20	20	20	20	20	20	20	20
1810	125	130	70	89	128	158	191	127	50	52	20	20	20	20	20	20	20	20	20	20
1820	71	81	45	87	53	78	60	77	140	49	20	20	20	20	20	20	20	20	20	20
1830	155	100	83	110	136	86	76	85	97	152	20	20	20	20	20	20	20	20	20	20
1840	170	154	72	101	70	113	123	22	100	106	20	20	20	20	20	20	20	20	20	20
1850	92	55	111	58	96	112	73	70	89	48	20	20	20	20	20	20	20	20	20	20
1860	132	41	39	59	61	86	130	138	169	158	20	20	20	20	20	20	20	20	20	20
1870	83	46	81	56	76	67	67	158	105	48	20	20	20	20	20	20	20	20	20	20
1880	42	67	125	57	119	104	67	129	95	81	20	20	20	20	20	20	20	20	20	20
1890	95	139	50	35	63	123	54	127	119	8	20	20	20	20	20	20	20	20	20	20
1900	48	104	65	87	4	165	217	216	249	154	20	20	20	20	20	20	20	20	20	20
1910	89	160	182	99	150	148	159	158	53	167	20	20	20	20	20	20	20	20	20	20
1920	200	143	96	57	141	13	176	134	84	73	20	20	20	20	20	20	20	20	20	20
1930	110	94	145	130	69	160	106	153	108	88	20	20	20	20	20	20	20	20	20	20
1940	134	200	118	124	154	118	32	109	142	116	20	20	20	20	20	20	20	20	20	20
1950	42	12	107	78	51	37	50	56	110	58	20	20	20	20	20	20	20	20	20	20
1960	90	56	76	52	108	133	53	75	99	96	20	20	20	20	20	20	20	20	20	20
1970	140	84	120								20	20	20							

SERIAL CORRELATION = .264 STANDARD DEVIATION = .409 MEAN SENSITIVITY = .416 N = 311

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